SEPTEMBER 1961

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

313 N FIRST ST
ANN ARBOR MICH

design
finishing
& use of:

Die Castings • Extrusions • Investment Castings • Permanent Mold Castings • Plaster Mold Castings • Powder Metallurgy Parts

Aluminum and Zamak

In All Standard Or Special Aluminum And Zinc Based Die Casting Alloys

ALUMINUM

ALLOYS

You're always sure of fast trouble-free production, less scrap and lower costs when you buy from your best source of supply.

- All ingot is quality controlled during production to insure uniform quality metal that is free from impurities and gas

ZAMAK

ZINC BASE DIE CASTING ALLOYS

- Composition is constantly checked to assure ingot meets your specifications
- All shipments are palletized and shipped with a certificate of analysis
- Deliveries are promptly made to meet your production schedule

ALUMINUM SMELTING & REFINING Co., Inc.

CERTIFIED ALLOYS CO.

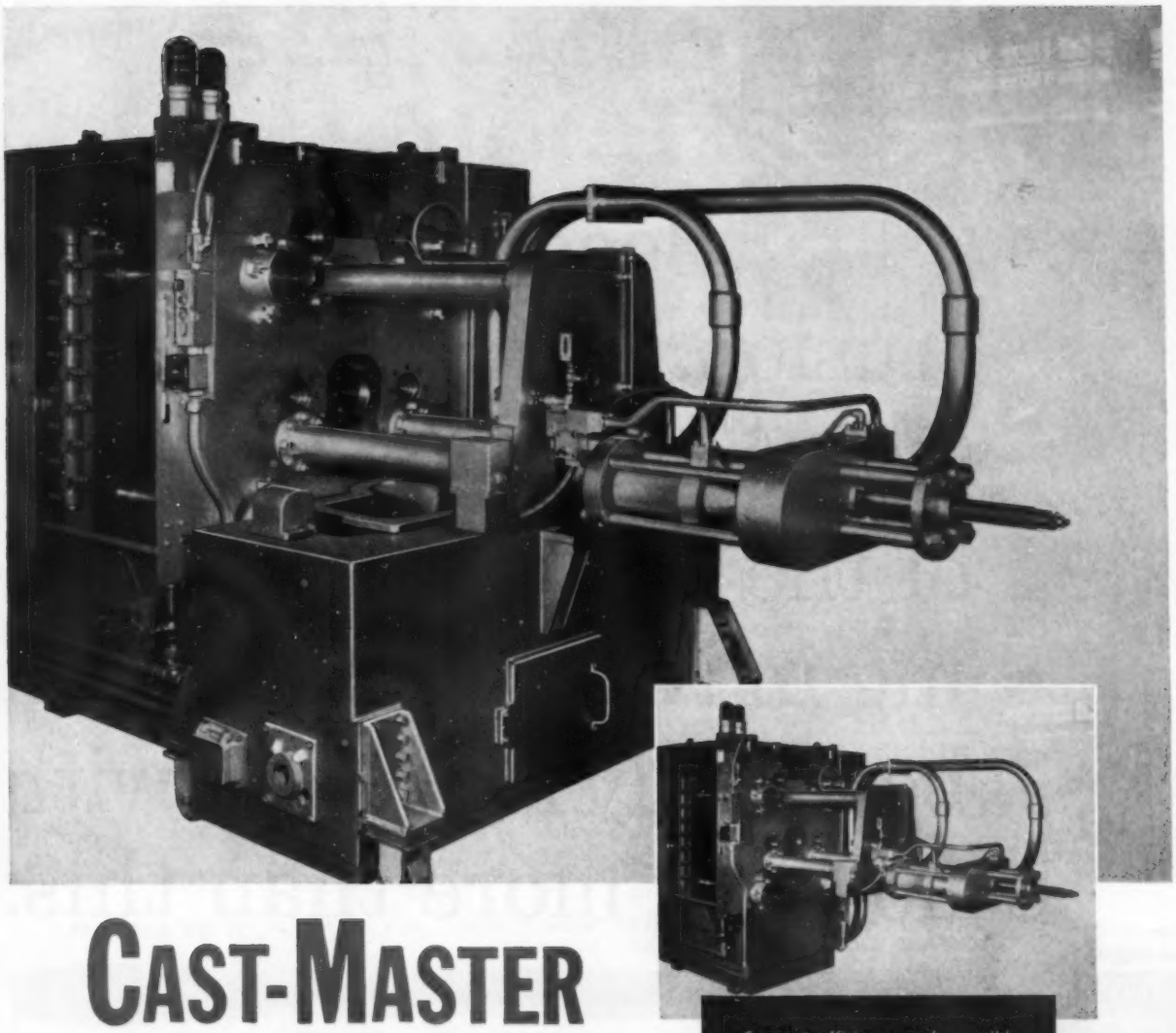
MAPLE HEIGHTS 37, OHIO
TELEPHONE: CLEVELAND MOhawk 2-5100

INDIANAPOLIS, INDIANA
3732 NORTH MERIDIAN • PHONE: WAlnut 5-9259

DETROIT, MICHIGAN
P. O. BOX [illegible] • PHONE: VAndyke 2-3200

LOS ANGELES PLANT
6235 BRENTWOOD ST., RIVERA, CALIF. • PHONE: OXford 9-5610

Circle No. 5 on Reader Service Card



CAST-MASTER

builds what the die caster needs

Compact efficiency made possible with redesigned injection end is illustrated. Injection and intensifier cylinders are side by side; high pressure piping is shown to rear of cylinders. Furnace rolls under injection assembly — out of the way and close to work station.

New convenience, new efficiency is illustrated in view with furnace removed. Cast-Master builds what the customer wants!

Backed by a program that is "customer-controlled", Cast-Master consistently strives to improve its machines. The latest in a long list of modifications, through the years, are illustrated. They include:

- **New 4-strain rod design provides better, *more accurate plunger alignment*.**
- **High pressure lines relocated — permit furnace to be used under injection cylinder (see small photo). *Removes hydraulic lines from furnace heat.* (Special piping arrangements upon request.)**
- **Simplified hydraulic circuit features subplate mounted valves, *less pipe and tubing*.**
- **Cast-Master shot intensifier system operates without valves. Instant intensification of injection pressure *improves casting quality — gives smoother finishes, decreases porosity*.**
- **Slow shot principle delays high speed injection plunger till after plunger passes metal pouring opening. (Eliminates splash.)**
- **Injection assembly is infinitely adjustable from minimum to maximum injection speed.**

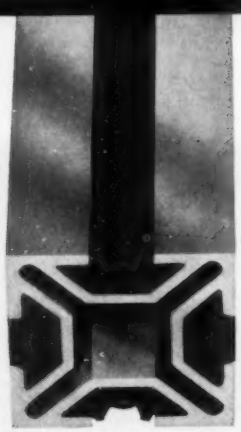
H-P-M DIVISION — KOEHRING COMPANY

CAST-MASTER

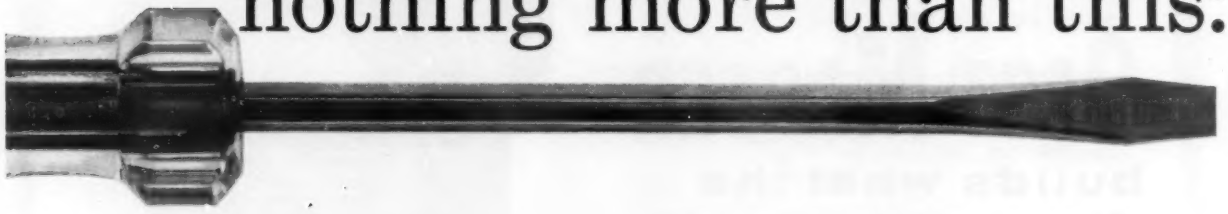
MOUNT GILEAD, OHIO, U.S.A.

H116

Circle No. 40 on Reader Service Card



Because of this extrusion, engineered with Olin Aluminum, 15 floors of the TIME-LIFE building in New York City can be quickly re-shaped with nothing more than this:



Olin engineers helped design this unique extrusion to serve as the universal junction of movable wall panels. The genius of this extrusion makes it possible to change office size, shape and color in jig time with nothing more than a screwdriver! So many Olin ideas like this have saved so much time and money for fabricators, designers and architects that modesty forbids telling all. As versatile as aluminum is, it doesn't think, doesn't create designs, or doesn't fabricate itself. That's why Olin Aluminum offers you the services of its marketing and technical staff. They "think aluminum." Don't you think it would be a good idea to call Olin?

Olin
ALUMINUM
400 PARK AVE., NEW YORK 22, NEW YORK

Circle No. 58 on Reader Service Card

PMM September, 1961: Volume 19 Number 9

Precision Metal Molding

PMM FORECAST

54 **WHAT THE PMM PARTS PRODUCERS FORECAST**
- 54 Die Castings
- 54 Die Casting for 1962
- 55 Zinc Die Castings
- 57 Magnesium Die Castings & Extrusions
- 58 Aluminum Extrusions
- 60 Investment Castings
- 61 Powder Metallurgy
- 63 Extrusion of Copper and Copper Base Alloy
- 63 Uncommon Extrusions

64 **THE UNITED STATES DIE CASTING INDUSTRY**
A statistical summary of the die casting industry
- 65 How big is the die casting industry?
- 67 What does the die casting industry buy?
- 70 How will the industry expand?

71 **THE INVESTMENT CASTING INDUSTRY**
A statistical summary of the investment casting industry

72 **THE POWDER METALLURGY INDUSTRY**
A statistical summary of the powder metallurgy industry

74 **THE EXTRUSION INDUSTRY**
A statistical summary of the extrusion industry

76 **WHAT'S NEW IN SURFACE FINISHING**
Parts made by the PMM processes are usually easy and economical to surface finish, but existing surface finishing methods leave much to be desired.

85 **WHICH INDUSTRIES BUY DIE CASTINGS?**
Statistical data shows the tonnage of die castings used by industry groups.

FEATURE ARTICLES

79 **SINTERED INSERT SHAVES COST OF DIE CAST ENGINE FLYWHEEL**
Powdered metal hub cast in a zinc die cast flywheel eliminates secondary machining.

80 **DESIGNING FOR POWDER METALLURGY**
The considerations for designing powdered metal filters and filter materials are described in this fifth article in a series on powder metallurgy applications.

84 **TWO MEN BURNED BY FLAMING OIL STREAM**
An editorial comment on fire-resistant hydraulic fluid.

105 **CYLINDER LINER CUTS RING WEAR**
Powdered metal cylinder liner provides longer engine life and cuts oil consumption.

105 **DIE CASTING SOLVES FINISHING PROBLEMS**
A handle for electrical equipment didn't look good enough until it was redesigned as a die casting.

114 **GATING ZINC DIE CASTINGS**
The fourth article in this series tells how to control the thickness of the gate opening to obtain a good die cast surface finish.

FINISHING SECTION

91 **NEW PORCELAIN ENAMEL FOR STEEL EXTRUSIONS**
Extra-low temperature frits let you specify porcelain enamel coatings on steel without causing design and application problems.

DEPARTMENTS

10 Casting About
23 New Products
27 Industry News
32 Letters
40 Books
101 Useful Literature
107 Data in Ads
120 Opportunities

Published monthly, copyright 1961 by
THE INDUSTRIAL PUBLISHING CORP.

To make the **BEST**...

Begin with the

BEST CASTINGS!

Latrobe Die Casting Co.

Aluminum Alloy Castings

Zinc Alloy Castings

Tin and Lead Alloy Castings

DISTRICT OFFICES

AKRON, OHIO
E. G. Siess, Jr.
227 W. Exchange St.
Tel: Portage 2-7663

CLEVELAND, OHIO
William Kranz
20001 West Lake Road
Tel: Edison 1-6888

DAYTON, OHIO
J. M. Gallaher
333 W. First St.
Tel: Baldwin 6-3418

DETROIT, MICHIGAN
Jay K. Esler
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thompson
P.O. Box 77
Old Saybrook, Conn.
Tel: Evergreen 8-9833

PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

Latrobe Die Casting Co.
Latrobe, Pennsylvania

Established 1918

Circle No. 44 on Reader Service Card

Precision Metal Molding

STAFF

David W. Veit ..... *publishing director*
Philip R. Kalischer ..... *editor*
Ronald Khol ..... *associate editor*
Thomas S. Palmer ..... *assistant editor*
Scholer Bangs ..... *western editor*
672 So. Lafayette Park Pl.
Los Angeles 57, California
Henry Lefer ..... *eastern editor*
Rm. 835, 60 E. 42 St.
New York 17, N. Y.
H. K. Barton ..... *foreign editor*
Hiram Barton Associates
Roughfield, Etchingham
Sussex, England
Bert Benkendorf ..... *art editor*
Mary A. Cindrich ..... *editorial assistant*

SERVICE DEPARTMENTS

Alaric Mausser ..... *art director*
N. G. Kiser ..... *circulation manager*
Robert Gauvin *mgr. reader service dept.*

SALES OFFICES

Cleveland 15
812 Huron Rd., SU 1-9620
ROBERT SIMMONS

New York City 17
Rm. 835, 60 E. 42 St., MU 7-3420
LEE HAAS, *manager*
ARTHUR L. GOEBEL

Chicago 11
Rm. 704, 520 N. Michigan,
WH 3-1655
CHARLES F. GEYER, *manager*
KENNETH L. JONES

Los Angeles 57
672 S. Lafayette Park Pl.,
DU 7-5104
ALAN T. CAZIER, *manager*
LLOYD BROOKMYER

London, S.W. 1, England
36 Victoria Street,
Sullivan 6072
JOHN A. LANKESTER, *manager*

SUBSCRIPTIONS in U.S. and possessions: $7 1 year; $12, 2 years. Canada: $8.50 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £ 3.5.0 per year payable in Sterling to London office. Single copies when available: 1 to 10 — 75¢ each; 11 to 25 60¢ each; over 25 45¢ each.

Out of print copies of PRECISION METAL MOLDING are available in complete volumes as positive microfilm copies from University Microfilms, 313 N. First St., Ann Arbor, Mich.

published monthly by
The INDUSTRIAL PUBLISHING CORPORATION
812 Huron Rd., Cleveland 15, Ohio

LESTER P. AURBACH ..... *president*
EDWIN M. JOSEPH .... *executive v. p.*
PAUL ROLNICK ..... *vice president*
N. N. GOODMAN, JR. ... *vice president*
LEE HAAS ..... *vice president*
CHARLES F. GEYER .... *vice president*
THOMAS L. DEMPSEY .. *asst. sect.-treas.*

AFFILIATED PUBLICATIONS: Hydraulics & Pneumatics. The Refrigeration & Airconditioning Business, Material Handling Engineering, Handling & Shipping, Modern Office Procedures, Occupational Hazards, Power Transmission Design, Welding Design & Fabrication. Member BPA.

Accepted as a controlled circulation publication at St. Joseph, Michigan. Not responsible for unsolicited editorial material. Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio. Printed in the U.S.A.

with America's finest facilities, equipment and men producing America's highest quality molds for the Die-Casting and Plastics Industries

ATOLS
Ultra-Precision
MOLDS

Yes, an all new plant, doubling previous floor area and increasing traveling crane capacity to 20 tons, equipped with the industry's most advanced tools, yet staffed by the same experienced men who have earned the praise of the nation's leading blue chip companies. We are proud of our new building but we take even greater pride in that many of the same companies whom we served at the very beginning of ATOLS are still our most valued customers. We dedicate our building to them and to those of you who take advantage of our invitation to investigate our facilities, our skill, our service.

For more than 25 years ATOLS has designed and produced precision made molds promptly and economically. We offer a complete service from design and engineering to the finished mold, with more than 100 men to serve you.

For complete details of our services and facilities, simply call or write. Your request will be answered promptly and courteously.

ATOLS TOOL and MOLD CORPORATION

3828 RIVER ROAD • Phone NAtional 5-6300 • SCHILLER PARK, ILLINOIS

Circle No. 94 on Reader Service Card

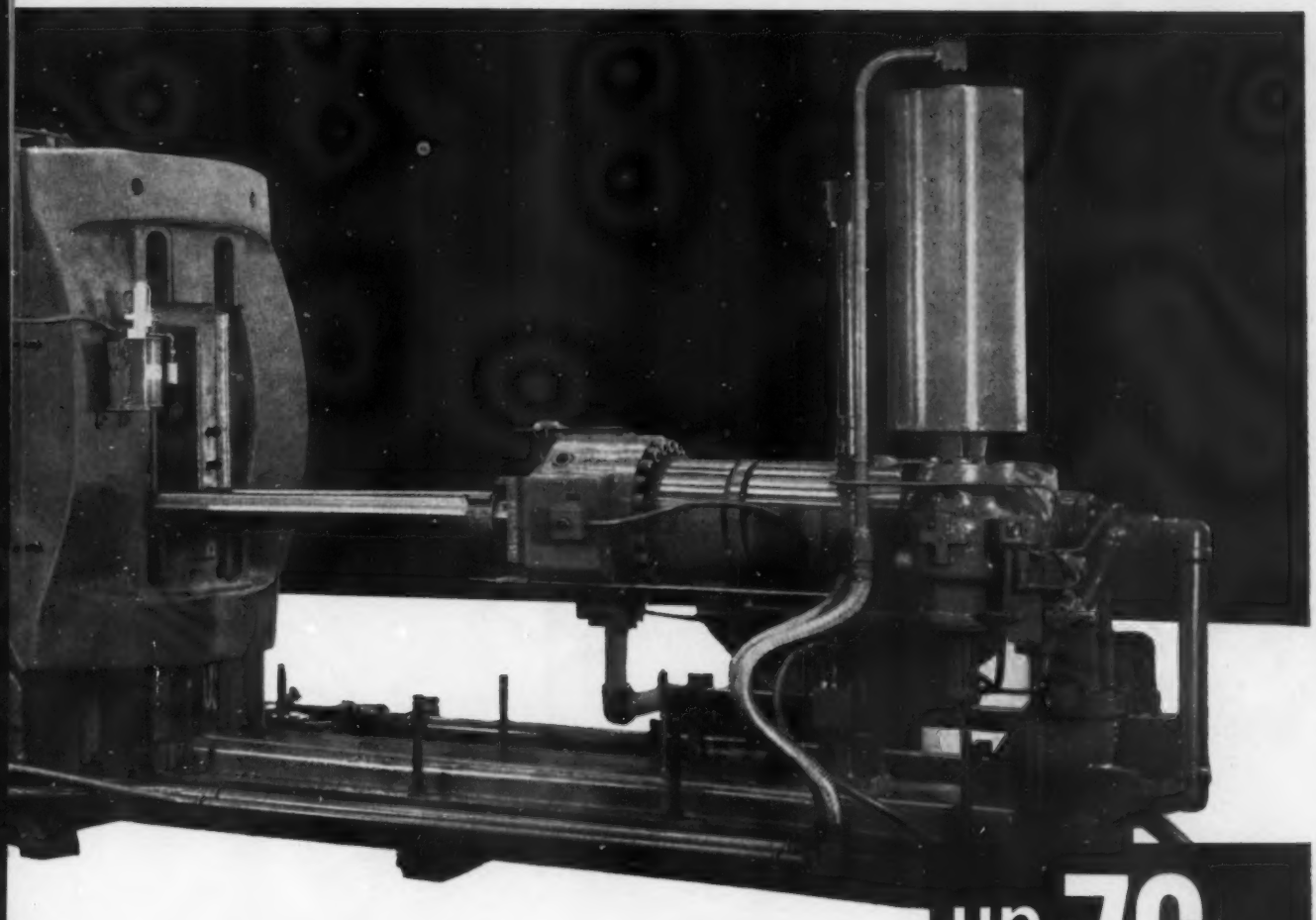
The 1600 Ton LESTER

Pacing the industry into gian

1600 Ton Lester Opens New Fields

76 pounds! That's a lot of aluminum to cast...takes a powerful machine to cast it. And that machine is the Lester HP-4½X-SF—the first frame-type die casting machine with 1600 tons of CERTIFIED CLAMP. Certified...like all LESTERS. ■ Anyone confronted with the problems of breaking in a giant die casting die will welcome the assurance that the clamp and accuracy of the one-piece cast-steel frame are reliable beyond question. ■ Here is a machine that opens doors to new thinking about BIG die casting applications. Who's next to take advantage of all the big features of the new 1600 ton LESTER? ■ Perhaps the manufacturer of washing machine barrels which need the generous 36″ die movement. Or the supplier of refrigerator doors with the supporting ribs cast in—easily accommodated on the full 6′8″ x 6′8″ platens. Will it be men producing lighting reflectors of giant proportions? ■ Yes, the 1600 ton LESTER is *big*...*big* enough to put a compact car

Truck Wheels Cable Reels Or Outdoor Lighting?



aluminum die castings... up to 76 lbs.

Holds A Car Between Its Platens

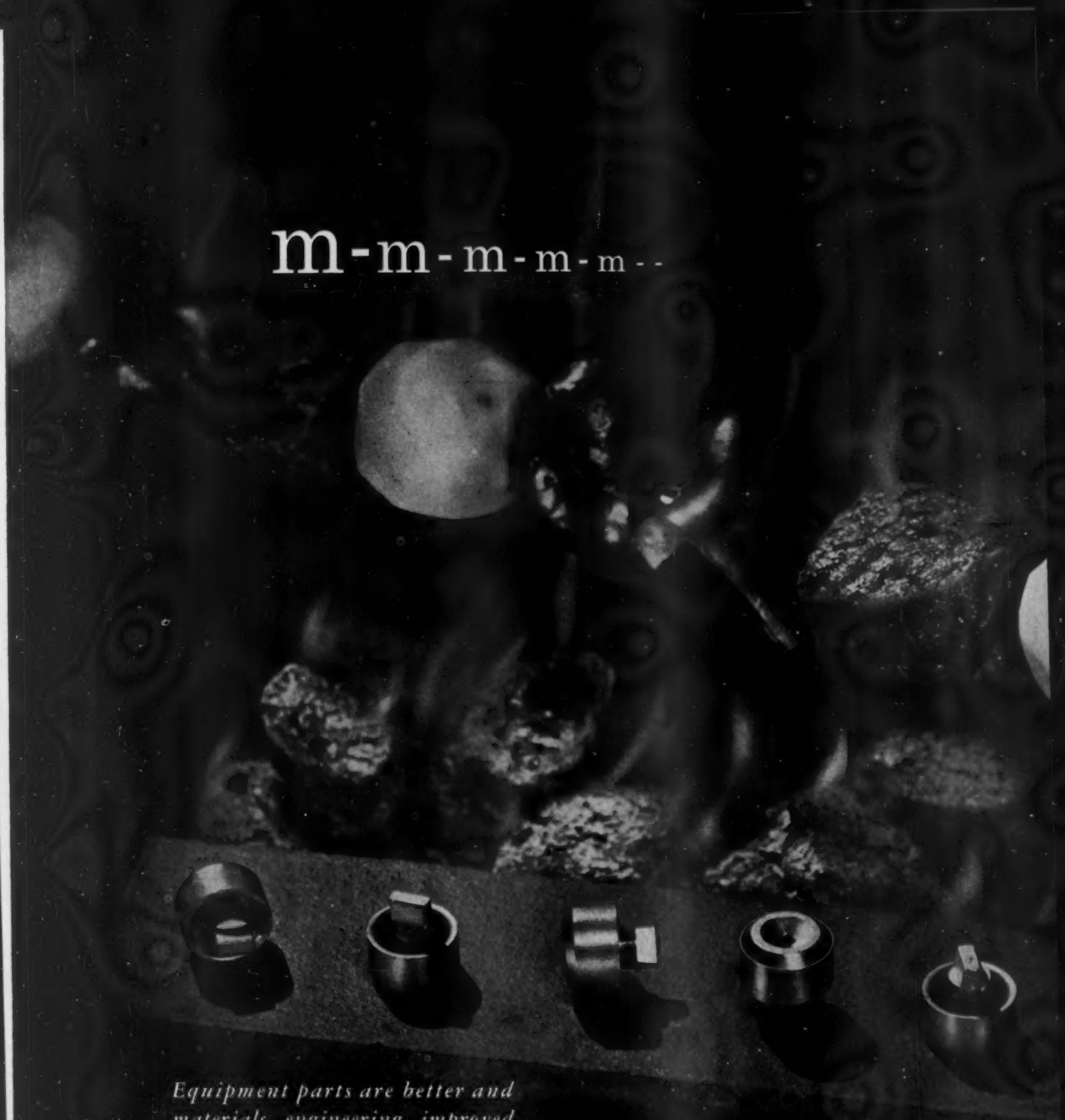
between its platens, powerful enough to crush a compact into a virtually solid block of metal, capacity enough to match the imagination of the men probing new fields for die castings. ■ Lester Die Casting Machines are available in capacities from 100 to 1600 tons, for aluminum or zinc. Detailed specifications are contained in Bulletin 102. Write for your copy today.

LESTER DIE CASTING MACHINES

Distributed by **Lester-Phoenix, Inc.** • **2708-M Church Avenue** • **Cleveland 13, Ohio**

Agents in principal cities throughout the world

Circle No. 46 on Reader Service Card



Equipment parts are better and materials engineering improved by the powder metallurgy process

Another example of product improvement. This barbecue part was fabricated by Metal Ceramics Company, Melrose Park, Illinois.

Powder Metallurgy can be the means by which *your product*, and your production costs, can be vastly improved.

Hoeganaes manufactures iron powders and high alloy powders. We sell and service the metal powdered parts fabricators . . . the men you should know.

May we send you literature? Or better yet, contact your metal powdered parts fabricator.

HSIC

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

Sales Representatives in Principal Cities

NOW! PROTECTIVE COATINGS

by vapor diffusion at MISCO

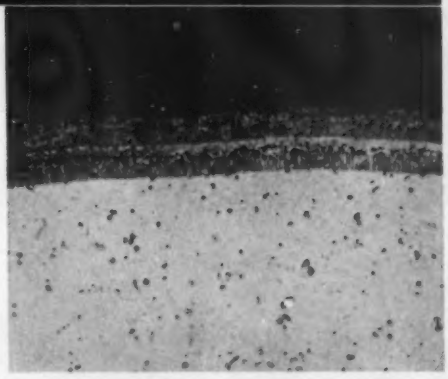
Misco Precision Casting Company has an exclusive license for North America, utilizing the patents, processes, techniques, arts and "know-how" developed by the German diffusion coatings' expert, Dr. Gottfried Becker of "DEW". A vigorous, progressive research program, backed by the facilities of both Misco and DEW, continues the development of new and even better diffusion coatings for both American and European alloys.

By diffusion coating, certain metals and/or alloys are deposited onto, diffused into, and alloyed with selected base materials to form a protective case, having desired characteristics for the intended service environment, such as—

- high temperature environments.
- corrosion resistance.
- wear resistance.

Misco Precision Casting Company, widely recognized for the service it provides its customers in the field of precision castings, NOW OFFERS THIS SAME PERSONALIZED SERVICE IN THE FIELD OF DIFFUSION COATINGS.

Our staff can serve you in the solution of your protective metal and alloy coating problems.



Composite coating diffused into nickel base alloy. (100X)

Chromium diffused into low carbon steel. (100X)

Misco Precision Casting Company

DIVISION OF HOWE SOUND COMPANY

MISCO

address inquiries to

VAPOR DIFFUSION DEPARTMENT

122 GIBBS STREET
WHITEHALL, MICHIGAN
TELEPHONE TWINOAKS 3-1515

Circle No. 51 on Reader Service Card

PMM

casting about *technical news of applications & processes involving precision metal molding*

Magnet Collects Metal Inside Livestock

A new magnet developed by The Arnold Engineering Company should improve health and save lives among dairy herds. The magnet, held in the veterinarian's hand in the photo, resembles an over-size capsule. It is placed in the second of a cow's four stomachs where it attracts and holds pieces of metal swallowed by the animal.

Injestion of metal objects causes serious illness and death among livestock. Losses are estimated at 3% in dairy and beef herds.

The magnet rolls freely and aligns metal pieces along its sides, preventing them from piercing the animal's stomach walls. It retains its power of attraction for the life of the animal.

Magnets removed from animals at slaughtering time have had as much as three-quarters of a pound of metal attached to them.

Die Casting Dies Use Molybdenum Cores

The Ford Motor Company reports five times longer core life in die casting dies as the result of switching to molybdenum alloy cores for the production of aluminum carburetors. Ford formerly used standard H-13 die steel, hardened and chromium plated.

The moly alloy cores do not have to be chromium plated to minimize galling as do the steel cores, and they can be reworked economically. Despite the higher per-pound cost of the moly cores, they pay off in longer life, reduced maintenance and lower downtime. The alloy used for the cores contains 0.5% titanium and 0.08% zirconium.

In other research now being performed in industry, two approaches to combine the wear resistance of molybdenum with the hardness required in dies are being studied. One approach is vapor deposition of moly on tool steel by molybdenum carbonyl gas similar to the nickel carbonyl process. The other approach is based on the nitriding of moly surfaces.

Large Continuous Casting Machine Installed

A continuous, direct chill, casting machine, recently installed at the California plant of Michael Flynn Mfg. Company, is one of the largest machines of this type in existence. It simultaneously casts 24 billets of 6-inch diame-

ter and 20-foot length with a production rate over 20,000 lb. of billets per hour.

The machine features an exclusive mold design and an automatic metal flow control which greatly minimizes manpower requirements. It is claimed that the cast billets are of superior surface quality and internal structure. The casting machine was designed and built by Lobeck Casting Processes, Inc.

the standard of

excellence everywhere

the fleur de lis — AC your guarantee of quality. Quality AC alloys insure the utmost in uniform chemical composition and physical characteristics. In fact, we're so proud of our product – we ship it to you packaged in polyethylene. ■ AC maintains a complete warehouse inventory located in the heart of industrial America – to provide immediate dependable delivery when you want it – where you need it. ■ These are just a few of the reasons why Alloys and Chemicals Corporation is the fastest growing aluminum smelter in the country.

Our sales engineers and technical staff are available for consultation.

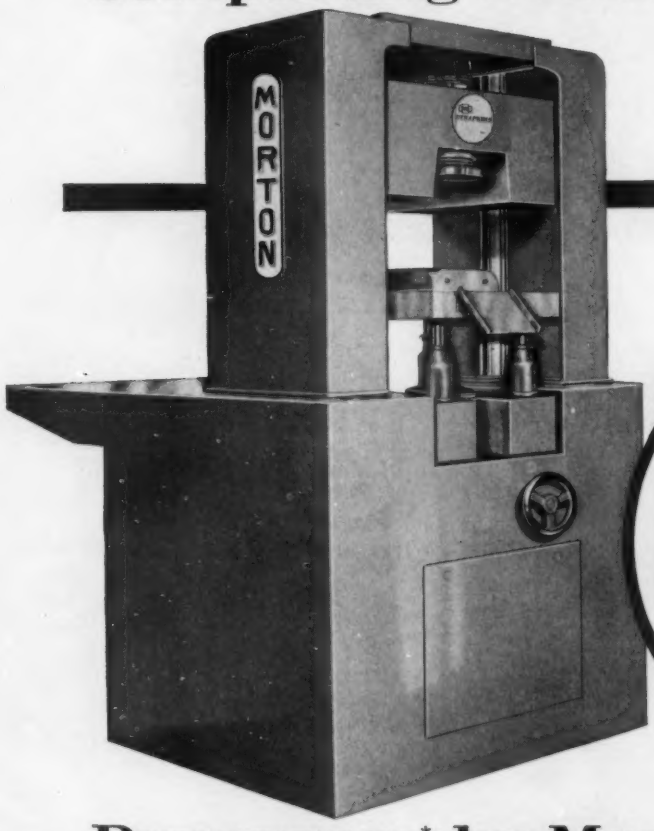
ALLOYS and CHEMICALS CORP.

Aluminum Alloys

4365 BRADLEY ROAD S.W. • CLEVELAND 9, OHIO • ONTARIO 1-8600

Circle No. 4 on Reader Service Card

What's New in Compacting Presses



DYNAPRESS 50

Dynapress* by Morton

*50 ton model illustrated. Available from 25 to 200 tons.

WITH THIS UNIQUE COMBINATION OF ADVANCED FEATURES

• Completely enclosed drive mechanism—cleaner, lower maintenance costs! • Hydraulically controlled floating die table—adjustable to the widest range of applications • Rugged design—radial guiding on upper and lower rams • Larger, more accessible die area—accepts the widest range of tools • Automatic Lubricating System plus many other operator convenience features. Truly dynamic in every respect. Call or write:

MORTON MANUFACTURING COMPANY
Muskegon Heights, Michigan

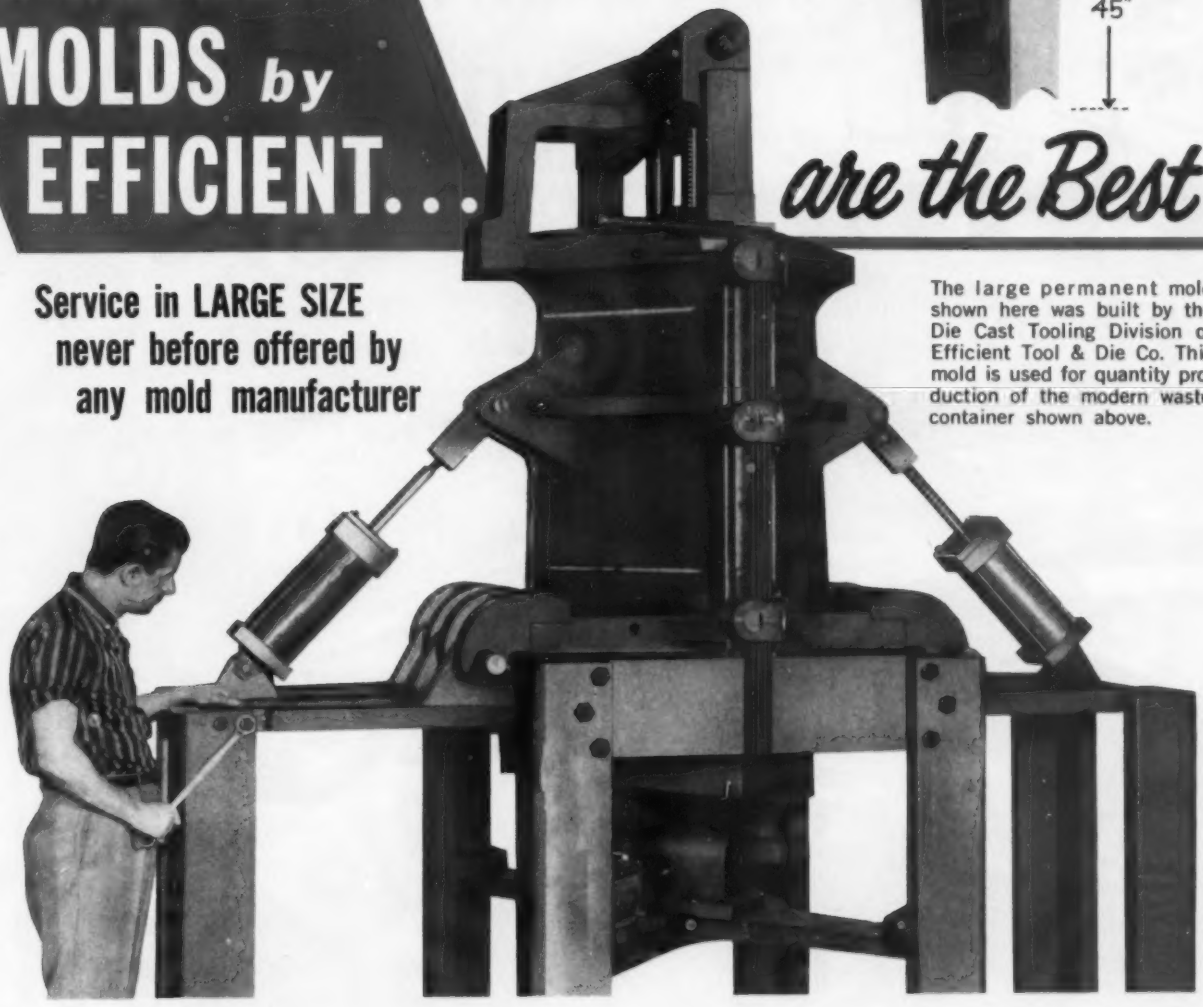
BUILDERS OF QUALITY MACHINERY SINCE 1880

Circle No. 54 on Reader Service Card

PERMANENT MOLDS *by* EFFICIENT... *are the Best!*

Service in LARGE SIZE never before offered by any mold manufacturer

The large permanent mold shown here was built by the Die Cast Tooling Division of Efficient Tool & Die Co. This mold is used for quantity production of the modern waste container shown above.



For your Permanent Mold requirements you can depend upon EFFICIENT'S engineering "know-how," experience and outstanding facilities.

Designers and Manufacturers of
Permanent Molds • Fiber Glass Molds Medium and Large Die Cast Dies • Die Cast Trim Dies • Models and Duplicating Aids (Testing Facilities)

Outstanding Facilities
Kellers — Hydrotels: Up to 6' x 12' Cutting Range, 11 Units • Boring Mills: Up to 7' x 12' Range, 9 Units • Complete Design and Engineering Dept. • Fully Equipped Model and Pattern Shop • Crane Capacity Up to 50 Ton • Production Floor Space 63,000 Sq. Ft. •

Here is a dependable, experienced large organization ready to work with you — in design, engineering and building the best and most efficient Permanent Molds—from medium to the largest sizes. Consult us, or inspect our two complete plants with the most modern facilities. Your request for information will receive prompt, courteous attention.

Write for Facilities Booklet and Equipment List

DIE CAST TOOLING DIVISION OF

EFFICIENT TOOLING

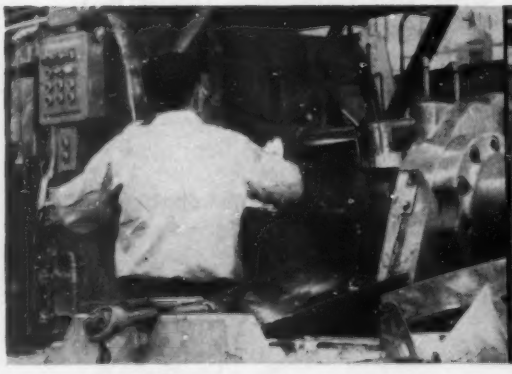
THE EFFICIENT TOOL & DIE CO.

9314 ELIZABETH AVENUE • CLEVELAND 5, OHIO

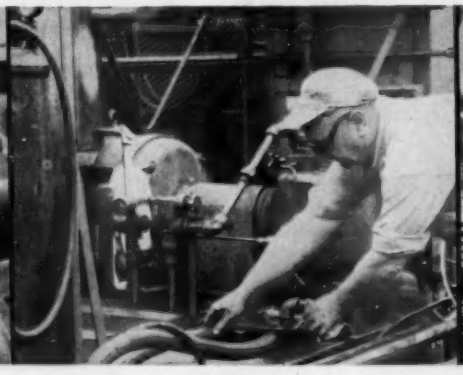
Phone: Diamond 1-5150 Circle No. 30 on Reader Service Card

PREVENTIVE MAINTENANCE with PYDRAUL®

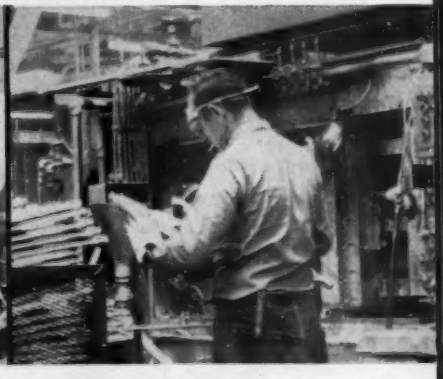
Electronic nerve center of Singer's mile-and-a-half-long conveyor system at Elizabethport, N. J.



PREVENT HAZARDS. Singer worker pours molten aluminum into a die-casting machine. There's no danger of flash fire or explosion even if a sudden hydraulic line break sprayed Pydraul fluid on hot metal or an open switch.



PREVENT HIGH UPKEEP. At Singer the hydraulic systems are filtered while the die-casting machines keep operating. The Pydraul fluid stays clear and clean. No corrosion. No drainage.



PREVENT DOWN-TIME. Singer's sixteen massive Lester-Phoenix die-casting machines must work around the clock to produce parts for 10,000 family sewing machines each week. Down-time can't be tolerated. Pydraul fluid helps prevent it.

The Singer Manufacturing Company speeds output, cuts upkeep time 75%

PROBLEM: 24-hour production, to meet demand for Singer's new Series 400 family sewing machines, made elimination of down-time *imperative.* Water-glycol hydraulic fluid in Singer's die-casting machines provided fire resistance... but the upkeep was formidable. Frequent pump and valve failure, rust, and sludge clogging were critical.

SOLUTION: Change-over to PYDRAUL A-200 fluid. Now, Singer's die-casting systems are filtered *while operating full blast.* Hydraulic systems stay clear and clean. No sludge, no rust, no wasted fluid.

RESULT: (1) greatly reduced down-time losses; (2) no valve replacements; (3) *total maintenance time cut 75%*... despite the fact that Singer now operates twice as many die-casting machines as before!

Says Al Schaefer, manager of Singer's Elizabethport, N. J., die-casting department: *"These operating economies are a direct result of our change to PYDRAUL A-200 fluid. In fact, the change not only solved rough maintenance problems but the permanence of PYDRAUL cut direct costs, too. This fluid doesn't evaporate. We don't have to drain it. And I think it gives us 100% better lubrication than the water-based fluid. No worry about fire, either."*

PYDRAUL fluids are straight synthetics—*chemically* compounded from fire-resistant materials; won't flash or flame after contact with hot ignition sources—*not even when sprayed through a 6,000° F. oxyacetylene torch flame* (AMS-3150B and MIL-F-7100 high-pressure ignition tests). PYDRAUL fluids contain no water to evaporate or corrode metal ... or throw your machine out of whack by rapid build-up in viscosity. Lubricity rivals the finest petroleum oils. PYDRAUL fluids perform well under line pressures up to 5,000 psi, at temperatures up to 300°F.

COMPARE VITAL PROPERTIES	PYDRAUL	Water-Glycol Fluid
Lubricity under heavy loads	Excellent	Fair
Oxidative stability	Excellent	Poor
Thermal stability	Excellent	Poor
Vapor pressure	Very low	High
Foaming resistance	Excellent	Fair
Oil compatibility	Excellent	Poor
FIRE RESISTANCE	Excellent	Excellent*

*provided water has not evaporated!

PYDRAUL fluids provide the *safety* you desire ... plus the *performance* you need. You owe it to yourself (and your workers) to get the complete facts on fire-resistant PYDRAUL fluids. Mail the handy coupon today.

PYDRAUL SAFEGUARDS die-casting machines • hydraulic presses • furnace tilters • mold casters • stampers • extrusion presses • ingot loaders • injection molding machines • forging presses. **Over 500 million machine hours' service proves PYDRAUL performance!**

Monsanto

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Industrial Fluids Dept. 4425-S
St. Louis 66, Missouri

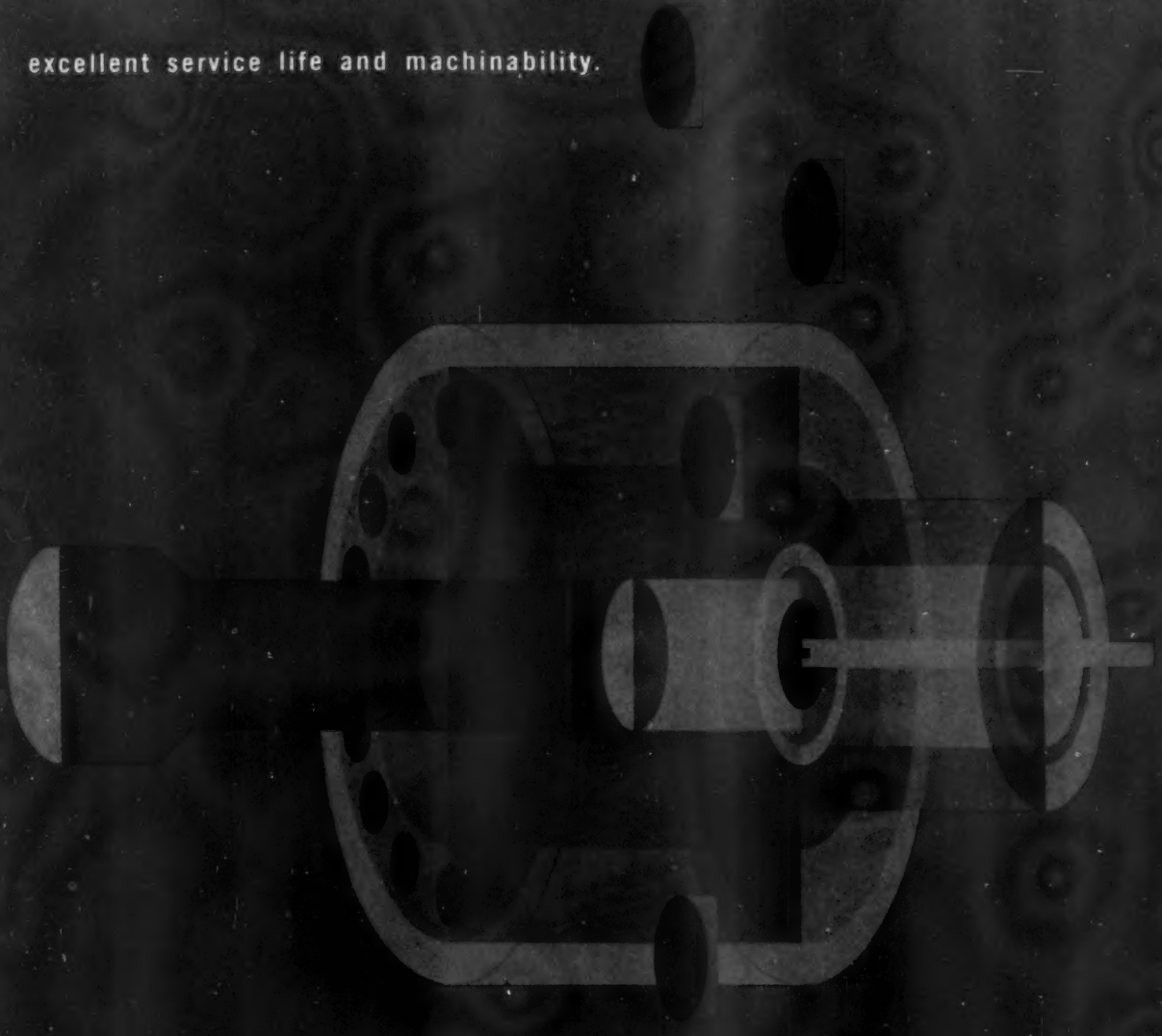
Please send me these new bulletins:
☐ "Know Your Fire Hazards"
☐ "Preventive Maintenance in Fire-Resistant Hydraulics"

*Name*_____
*Company*_____
*Street*_____
*City*_____ *Zone*____ *State*_____

Circle No. 53 on Reader Service Card

EXTRUSION DIE STEELS PRESS PARTS

Requirements for high quality containers, liners, stems and die blanks for the extruding of all metals and alloys can be met more efficiently and economically by Marathon. A wide range of steel grades is available, each one offering excellent service life and machinability.



MARATHON

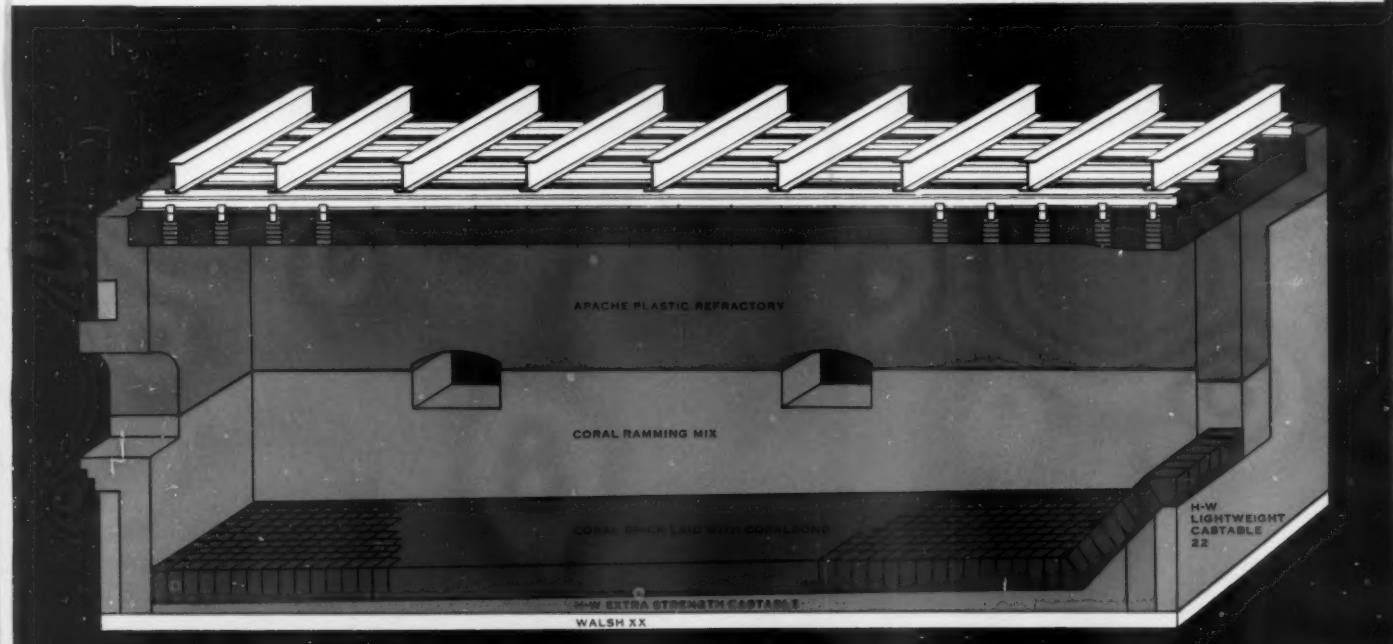
SPECIALTY STEELS, INC. CORPORATED

A Division of Deutsche Edelstahlwerke A.G., Krefeld, West Germany [illegible] Park Avenue, New York 22, N.Y.

THIS HIGHLY SUCCESSFUL ALUMINUM MELTING FURNACE FEATURING MONOLITHIC CONSTRUCTION WAS BUILT ENTIRELY OF HARBISON-WALKER REFRACTORIES.

Construction and product details are given on the following page. PHOTO: COURTESY OLIN-MATHIESON CHEMICAL CORPORATION

CORAL BRICK, CORALBOND AND CORAL RAMMING MIX WERE ESPECIALLY DEVELOPED BY HARBISON-WALKER FOR ALUMINUM MELTING FURNACES. THEY HAVE ALREADY DEMONSTRATED UNUSUAL RESISTANCE TO PENETRATION AND CORROSION BY ALUMINUM ALLOY REACTION . . . AS WELL AS TO THERMAL SHOCK, SPALLING CONDITIONS, AND SEVERE IMPACT AND ABRASION. THE REFRACTORY USED IN EACH FURNACE SECTION WAS SELECTED TO ASSURE THE BEST BALANCED SERVICE LIFE.



WALSH XX

A strong, power pressed, high duty fireclay brick.

H-W EXTRA STRENGTH CASTABLE

A refractory concrete of outstanding physical strength.

CORAL brick, laid with CORALBOND

These specialized high-alumina brick and mortar have exceptional high strength to withstand spalling and slagging influences, and provide remarkable resistance to molten metal reaction.

CORAL RAMMING MIX

This companion product to CORAL brick and CORALBOND, installed by gunning or ramming, has excellent resistance to molten aluminum alloys and develops great strength at operating temperatures.

H-W LIGHTWEIGHT CASTABLE 22

An insulating monolith.

APACHE PLASTIC REFRACTORY

A high alumina (60%) monolith with refractoriness equal to brick of this class but with much lower permeability.

WRITE FOR DATA

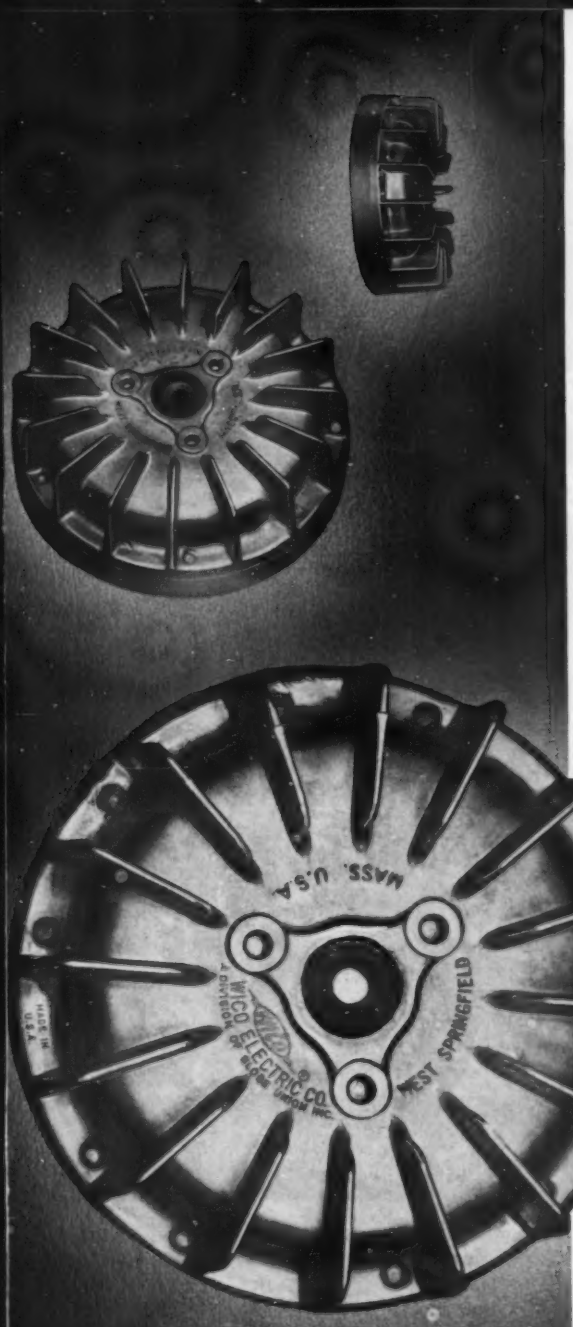
Complete product descriptions and test data are available showing the superior resistance of these refractories to aluminum alloy reaction.

HARBISON-WALKER REFRACTORIES COMPANY AND SUBSIDIARIES

GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

HW 81-7



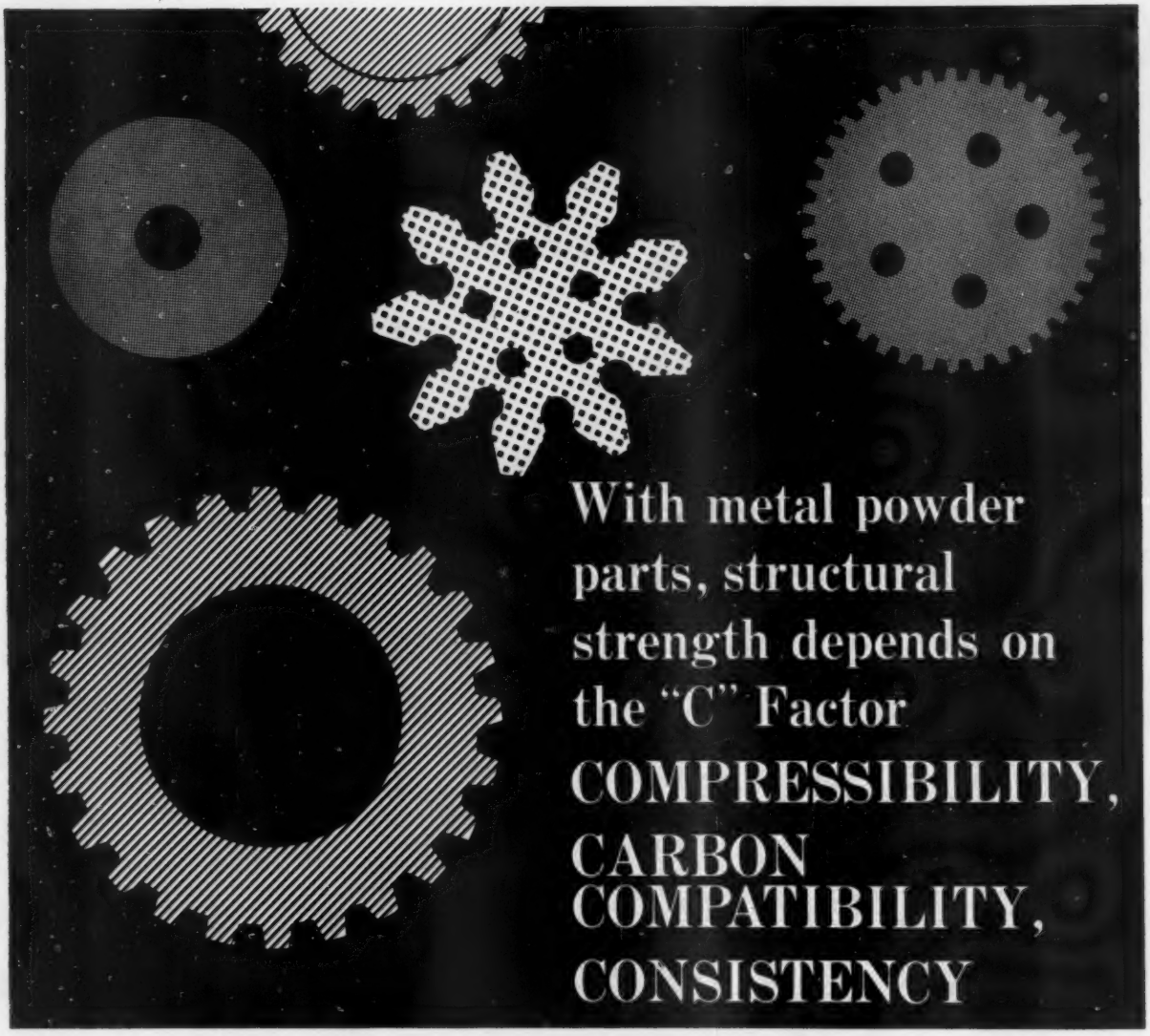
FEDERATED ALUMINUM

You can get closer to really trouble-free die casting

You will get fewer casting rejects with Federated aluminum die casting alloys, because you know how the alloys will behave. Only careful quality control can assure you of identical alloys from batch to batch. And it takes the finest of analytical equipment to determine that alloy constituents are the same time after time. The Federated Metals Division has the latest spectrographic equipment at its producing plants and is backed by complete facilities of Asarco's Central Research Laboratories to help assure you of consistent quality. Federated's nation-wide system of conveniently located stockpoints and sales offices is your assurance of prompt delivery. In addition, trained field metallurgists are available to analyze your problems and recommend solutions. For further information about these quality aluminum alloys, call your nearest Federated sales office or write to: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5. *In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.*

ASARCO

Circle No. 7 on Reader Service Card

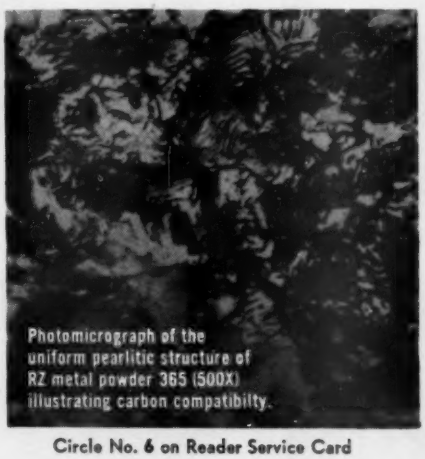


...and only Easton's exclusive RZ iron atomizing process offers the "C" factor! Easton's molding grade powders produced by the RZ process flow better, compact more readily and extrude more easily than powders made by other processes. The flexibility of the RZ process permits variation in the density and surface characteristics of the metallic particles for optimum compressibility... controlled hydrogen loss contributes to high carbon compatibility for improved strength. Close control of chemistry and particle size distribution in the processing and final blending assures the homogeneity and complete consistency of each lot. For quality sintered parts and high density structural applications, select Easton RZ powders in the following grades:

Molding grade powders
RZ 365
RZ 365–HD
RZ 365–M
RZ 365–P
RZ 365–S
RZ–200
RZ–4600 Alloy

"Sintrex" electrolytic grade powders
D–E–F

Custom powders
1. Preblends
2. Customer Specifications


Photomicrograph of the uniform pearlitic structure of RZ metal powder 365 (500X) illustrating carbon compatibilty.

EASTON METAL POWDER COMPANY

EASTON RZ

Division of American Mannex Corporation

900 Line Street, Easton, Pa.

BLackburn 8-6171

Circle No. 6 on Reader Service Card

Helpful Hints for Die Casters

—from Bethlehem's Tool Steel Engineer

How to Combat Heat-Checking in Hot-Work Tools

Tools which are moderate in hardness do an effective job of resisting heat-checking. However, soft tools wear rapidly, and chances are good that they may deform under service loads. Therefore, a compromise is always necessary in making hot-work tools.

Hot-work tools should be soft enough to avoid rapid heat-checking, yet hard enough to avoid deformation under the service load. How does one determine the wide range of hardness which will meet these requirements? Experience is by far the best teacher. When the hardness range is established, the hardness of the tool is always maintained on the high side of the range to provide maximum wear-resistance.

Hot-work tools which give satisfactory service are normally removed from service because of wear. Examination of such tools usually shows the working surfaces to be severely heat-checked. This condition, where wear and heat-checking have progressed simultaneously, represents the proper working level of hardness. The use of a higher hardness would cause failures from gross cracking or from heat checks; lower hardness would allow more rapid wear.

Steel *for Strength . . . Economy . . . Versatility*

Super shock-resisting and air-hardening BEARCAT is ideal for many hot-work tools

Bearcat is Bethlehem's super grade of shock-resistant air-hardening tool steel. It's ideal for many tough hot-work applications . . . dummy blocks, rivet sets, hot headers, gripper dies, and extrusion-press support tooling, for example. When tempered in the higher range, it's an excellent hot-work performer where the operating conditions do not require the temperature of the tool to be higher than 1000 F.

Bearcat has high wear-resistance. And because it's an air-hardening grade, it minimizes quenching hazards and distortion in heat-treatment.

Bearcat is also ideal for applications involving shock, because of the way it withstands repeated impact, yet keeps coming back for more.

For a really tough tool steel—one that cuts operating costs—you'll find it hard to match Bearcat. Full information is available from your Bethlehem tool steel distributor.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

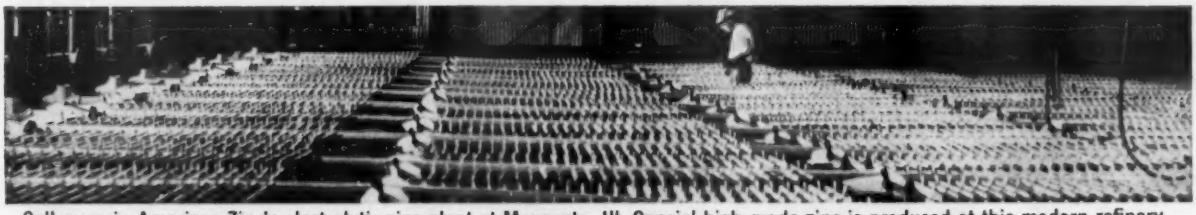
BETHLEHEM STEEL

Circle No. 16 on Reader Service Card

INTEGRATED PRODUCTION—from Ore to Ingot

Underground scene in American Zinc's East Tennessee zinc mines. More than 50 years' reserve of zinc ore has been developed here.

Assures the Uniformity and Purity of



Cell room in American Zinc's electrolytic zinc plant at Monsanto, Ill. Special high-grade zinc is produced at this modern refinery.

AZCO Zinc Die Cast Alloys

Latest spectrographic analyzing equipment is employed to assure accurate control of alloys at all times.

You set your specification—get your specification with AZCO Zinc Die Cast Alloys. AZCO Alloys are produced from American Zinc special high-grade slab zinc—quality controlled from ore to ingot to assure the purity and uniform analysis you need for trouble-free production. From our Monsanto, Illinois, plant in the center of the "Zinc Zone," you get the fast, dependable service you need to meet your production schedules. Phone for immediate attention.

American Zinc sales company

1515 Paul Brown Building, St. Louis 1, Missouri

Distributors for:

AMERICAN ZINC, LEAD AND SMELTING COMPANY

Detroit • Columbus, O. • Chicago • St. Louis • New York

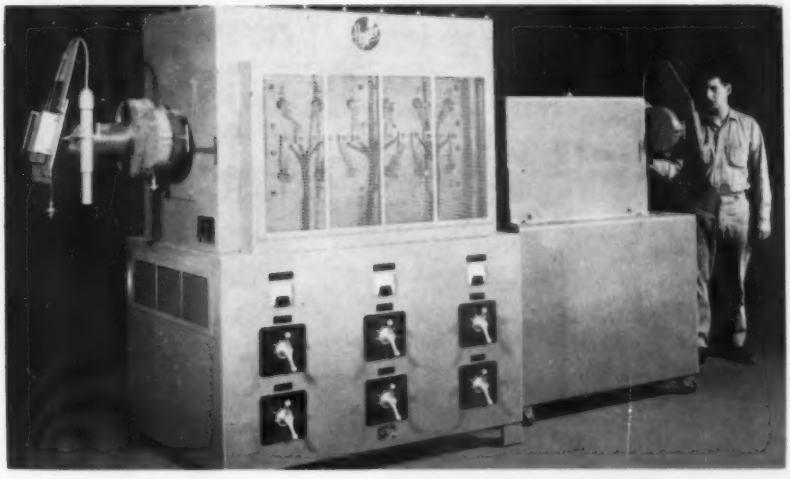
AZCO

Circle No. 8 on Reader Service Card

PMM

new products & developments *qualified readers can get complete details on these products. Use the reader service cards.*

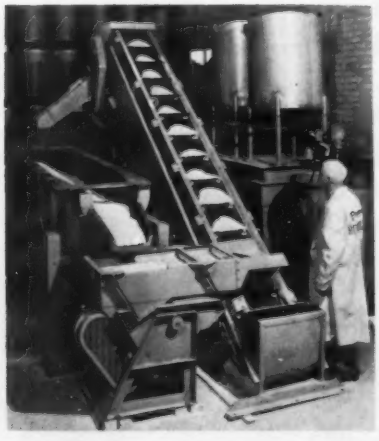
Zoned tube furnaces



HARPER ELECTRIC FURNACE CORP.—A new line of modernized zoned tube furnaces feature interchangeable components for increased versatility. Muffles, entrance chambers, water-cooled sections, and other optional features can be removed or replaced to meet changing research and production requirements. Air and controlled-atmosphere models are available in heated lengths from two to four feet with three-, four-, and five-inch I.D.'s for firing, calcining, sintering, brazing, annealing, oxidizing and general heat treating.

Circle No. **235** on Reader Service Card

Continuous vibratory finishing installation



PANGBORN CORP.—Fully automatic, continuous vibratory finishing installations clean, descale, deburr, radius, grind, fine finish, color, and burnish with the same precision as standard-type units. Work may be fed or conveyed automatically into and out of the machine. Media are automatically cleaned, screened and recirculated. Compound and water are added automatically.

Provisions can be included for fixturing large and heavy parts or batch-finishing exceptionally long parts. The machine can operate without supervision.

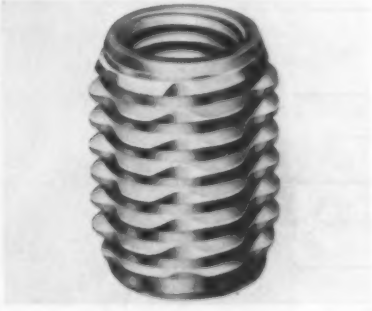
Circle No. **236** on Reader Service Card

Metal powders for nuclear application

ASTRO-ALLOY CORP.—A pre-alloyed heavy metal powder is now on the market containing tungsten, nickel and copper in any desired composition. These high-density alloys are used as radioactive shields and containers for radioactive materials, absorbing x-rays and gamma rays. The alloys are about 1½ times as effective as lead against radioactive penetration.

Circle No. **237** on Reader Service Card

Self-tapping insert



SPEEDSERTS, INC.—This self-tapping insert for providing strong threads in aluminum, magnesium and other relatively soft metals does not form chips. The wave form of the thread rolls through the base materials with a zero tolerance fit without cutting. The base material is pushed back gently, and then returns behind the wave crest to lock the insert and keep it from backing out.

The inserts have chamfers at both ends, making them easy to install from either end. This facilitates hand-feeding and simplifies automated arrangements.

Circle No. **238** on Reader Service Card

more New Products on page 109

NOW . . . mold larger powdered parts with a die fill this deep!

NEW BALDWIN 200-TON COMPACTING PRESS

Just delivered to the appliance and automotive parts industries—two new Baldwin 200-ton mechanical compacting presses with 9-inch depth of fill in the die cavities.

For the first time you can get a 50% deeper fill in a trouble-free mechanical compacting press by Baldwin.

Assures you the speed and profitable production for which Baldwin mechanical presses are noted. Operates at 6 to 24 strokes per minute. Die opening is approximately 12 inches. Readily adaptable to use of multiple cavity dies. Pressurized lubrication and enclosed drive keep maintenance costs low.

Write for specifications and application engineering help that will save you time, trouble and money.

BALDWIN · LIMA · HAMILTON

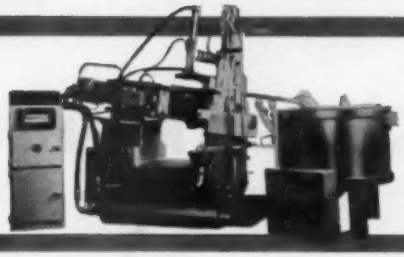
Industrial Equipment Division · Philadelphia 42, Pa.

Circle No. 15 on Reader Service Card

The revolutionary

DCMT RAM

FULLY AUTOMATIC



The fully automatic DCMT RAM averages 1500 shots per hour... **requires no operator!** 60 ton lock, 1 lb. capacity.

DCMT MAC 99

Automatic Cycling Die Casting Machine

15 Ton • 1 lb. capacity

FIRST TIME...

a basic modular Die Casting Machine with plug-in accessories, available at your option for utmost flexibility and efficiency!

FEATURES: push button panel (see below) • **90° convertible die unit** and **removable spacer plate** (see below) • **broader and huskier base** for greater stability and less vibration • **new solenoid-operated valve system** with **speed control** for die setting and shockless cycling • **exhaust mufflers** for quiet operation • Optional features: **electronic timer unit** (see below) for automatic cycling • **a brush device** mounted over the dies, cleans and lubricates the die faces (see below).

B.I.C. ENDORSED QUALITY

PUSH BUTTON PANEL

Mounted on side of machine away from die parting line. Push buttons for manual cycle and for automatic single cycle. Electrically interlocked for safety.

ELECTRONIC TIMER UNIT

Entirely enclosed in a metal container. Can be attached instantly to the control panel with quick-connect plugs, and be placed away from machine.

4-WAY ADJUSTABLE AND REMOVABLE DIE UNIT

Can be adjusted with tie bars horizontally or vertically. Spacer plate is removed for center gating. These four adjustments provide greater die setting flexibility.

BRUSH DEVICE

Mounted over the dies. Cleans and lubricates the die faces. Phosphor bronze brushes placed in segments for desired adjustment and easy replacement.

DCMT SALES CORP.

Division of British Industries Corp.
Port Washington, N. Y.

DCMT Sales Corp., Dept. DF 1541
Division of British Industries Corp.
Port Washington, N.Y.

Gentlemen:
Please send literature:

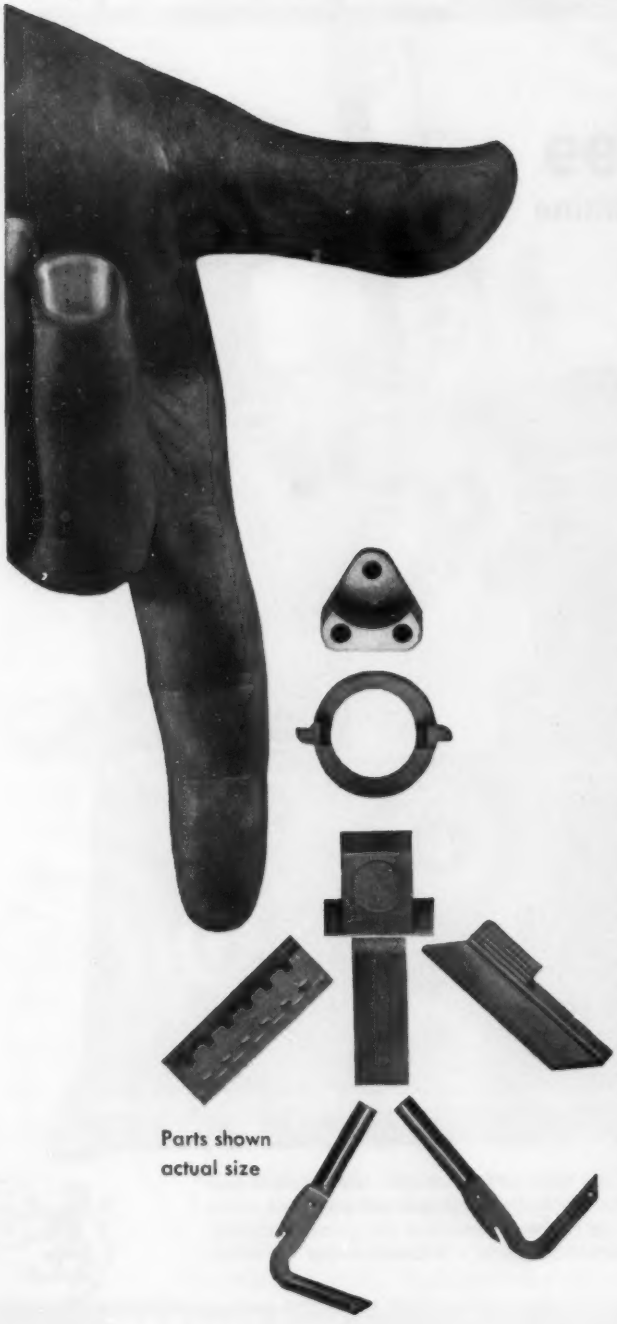
- ☐ DCMT MAC 99
- ☐ DCMT RAM

Name:.....

Company:.....

Address:.....

V-R INVESTMENT CASTINGS



Parts shown
actual size

in metals that meet your specific needs

- Resist abrasion
- Resist corrosion
- Resist temperature extremes
- Withstand shock
- Non-magnetic

Do your small parts require any of these characteristics? V-R Investment Castings in alloys such as Tantung, cobalt and nickel base metals, stainless steels, beryllium coppers and copper base or silicon bronzes are readily available. Other alloys, with specific physicals, can be developed and cast to meet your requirements. Irregular shapes, unusual contours and exacting detail on internal and external surfaces are accurately and economically produced. V-R Investment Castings are the practical answer to many of your small parts designing problems. Write for complete information today.
VASCOLOY-RAMET CORPORATION,
870 Market Street, Waukegan, Illinois.

The outstanding properties of Tantung are also available in larger parts produced by other casting methods.

V-R FIRST CHOICE of more and more designers

I-850

Circle No. 72 on Reader Service Card

PMM

news of industry & associations *activities of people, companies & groups in the precision metal molding industries*

promotions & changes

Ajax Magnethermic Corp.—*Harley F. Gauker* has been named assistant division manager, and *James R. Coley* has been promoted to sales manager. Both are at the Trenton Division.

Crucible Steel Co. of America—*William R. Mogg*, formerly assistant director of product development, has been appointed assistant director of metallurgy-technical services.

Reynolds Metals Co.—*Gilbert R. Shockley* has been named general director, product development division. Mr. Shockley will be in charge of the company's development laboratories in Richmond and Louisville.

Alloys & Chemicals Corp.—*L. A. Kristoff* has joined the company as executive assistant. In addition to his executive duties, he will head the newly formed Special Products Division.

Precision Castings Co.—*Ralph Lyle Linder* has been appointed vice president-general manager-Cleveland Division. He came to the firm in 1960, and replaces *A. D. Weigolt*, former vice president who recently retired.

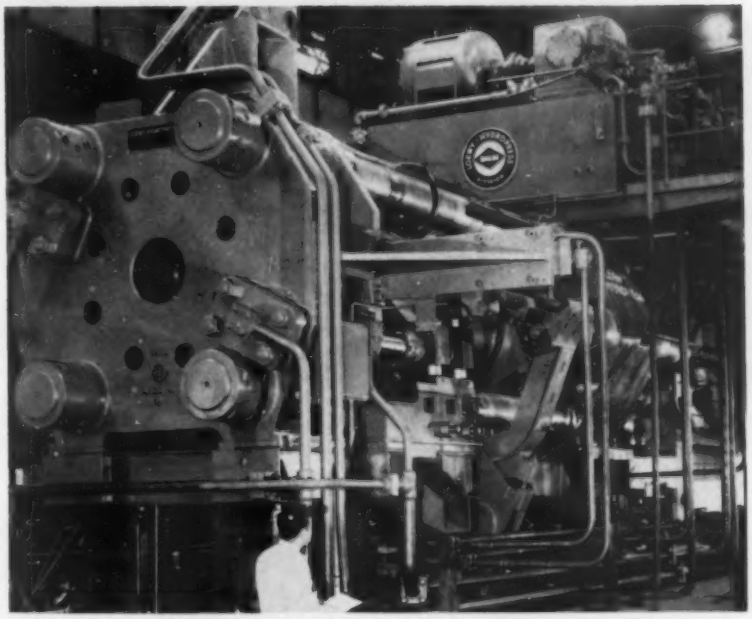
Allied Research Products, Inc.—*Robert B. Cassidy* has been named sales engineer for the southern territory.

Harbison-Walker Refractories Co.—*Charles R. Hauth* has been appointed assistant manager-technical sales.

Metal Atomizing & Processing Corp. Ltd.—*Walter Irwin* has been appointed president.

more on page 100

Channel-Master installs 3,000 ton B-L-H extrusion press



Channel-Master Corp. has installed a new, self-contained hydraulic press of 3,000-ton rating at its plant in Ellenville, N.Y. The press was built by Baldwin-Lima-Hamilton's Industrial Equipment Division, and was displayed publicly at the recent meeting of the Aluminum Extrusion Council at Ellenville.

Producing as many as six smaller-diameter extrusions simultaneously through multiple-hole dies. The press has a fast dead cycle time of 21 seconds. Stroke of the main ram is 66 inches. Shear capacity is 100 tons; continuous stripping capacity is 285 tons and continuous sealing capacity, 228 tons. A die stack 18 inches deep by 18 inches in diameter can be accommodated.

The press incorporates such design advantages as a fully mechanized system for removing butt ends and dummy blocks, external jackscrew adjustments for speedy billet changing and centering, and a double die slide arrangement, which permits one set of dies to be prepared for extrusion while the second set is in operation.

The furnace-to-press conveyor system performs a timing function which permits air-cooling of the billets to extrusion temperature.

more Industry News on page 29

COLEY

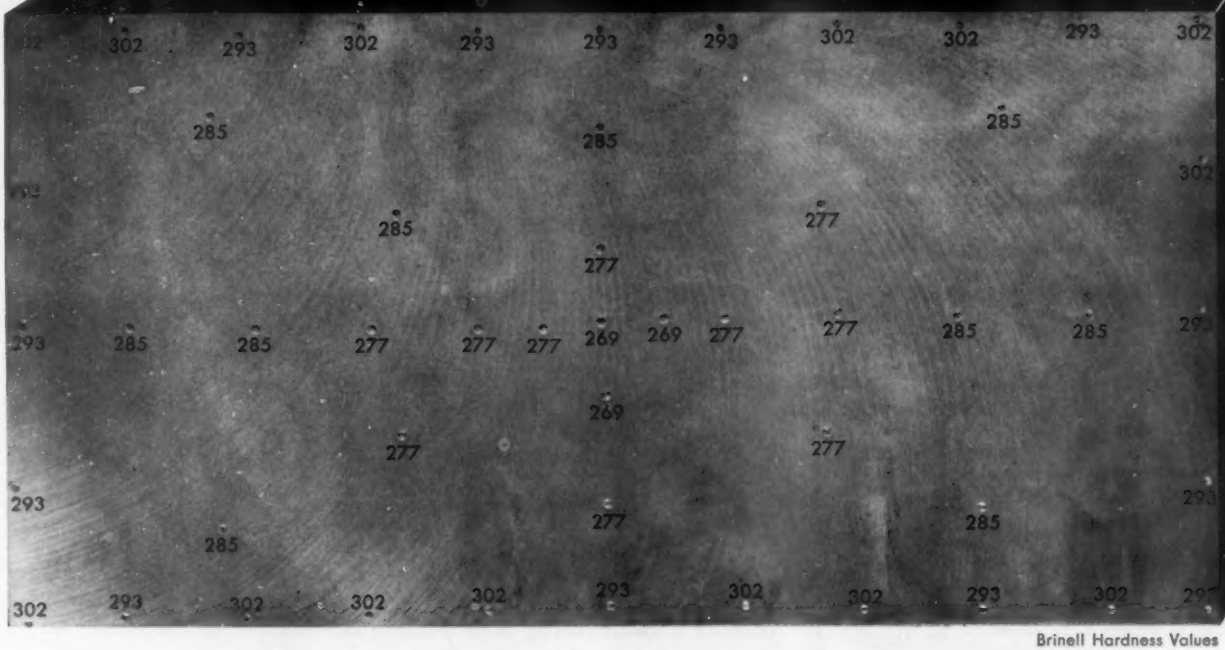
GAUKER

MOGG

SHOCKLEY

KRISTOFF

LINDER



Brinell Hardness Values

Better finishes for larger, longer-running molds and dies

This photo shows exactly why Crucible CSM 2 helps you build better molds and dies. Prehardened CSM 2 has more uniform hardness throughout the cross section. You can see this yourself in the 20"x10" specimen above, which was cut through the center of an 8-ft. forged bar. Just look at how constant the Brinell hardness values remain—across the surface...and from surface to center!

NEW **DENSIFYING** PROCESS IMPROVES CENTER SOUNDNESS—To uniform hardness has now been added greater center density. This is accomplished by **DENSIFYING**, a new process developed by Crucible which involves more than the normal consideration of steel analyses and amount of reduction. It includes careful appraisals of ingot size and shape, processing temperature control, and special methods of reduction.

This combination of higher hardenability and more uniform *density* ensures: more uniform polish from top to bottom of the cavity; greater resistance to washing at the cavity's center or bottom; more positive shut-off surface, particularly in internally landed molds and dies; more uniform machining characteristics from top to center of the cavity. It also eliminates the need to heat treat plastic injection molds and zinc die casting dies in sections up to 14" or 15" thick.

For further information on higher hardness, **DENSIFIED** CSM 2 and NU-DIE V® (H-13) mold and die steels, call your local Crucible steel service center. *Crucible Steel Company of America, Four Gateway Center, P.O. Box 88, Pittsburgh 30, Pennsylvania.*

CRUCIBLE STEEL COMPANY OF AMERICA

Circle No. **21** on Reader Service Card

news of industry & associations

Continued

Micro Metals produces chemical grade iron powder

Philip L. Bornstein, president, of Micro Metals Corp. has announced that the company has started full-scale production of chemical grade iron powder.

The firm, by using patented designs and specially constructed pulverizing mills, can mechanically produce metal powders in a wide range of particle sizes.

The process, according to a company spokesman, is designed to turn out chemical grade iron powders which are "one-half as costly as the least expensive molding grade powders."

Howe Refining produces aluminum additives

According to H. D. Wallach, vice-president, Howe Refining Corp., a subsidiary of Howe Sound Co., has begun production of aluminum additives to be known as Master-alloys and Hardeners.

The new facility, to be managed by Mr. John Gehrm, will make a new two- to four-ounce size piglets which are added to remelt and primary aluminum. Titanium, chromium, manganese, or boron are available in conjunction with aluminum either individually, or in various combinations as desired.

Special mixtures and custom alloys will also be available to customers who are involved in wrought and foundry work, as well as gas-free additions for the high-temperature metals field.

Northwestern Metal Co. building new plant

Ground has been broken for a new automated non-ferrous smelter and scrap-handling facility for Northwestern Metal Co. in Lincoln.

The new 67,000 square foot plant, located on a 23-acre site in Lincoln's North Side industrial park will be equipped with gas-fired reverberatory aluminum, brass, and white metal melting and holding furnaces. It will also have conveyorized ingot moulding machines and the latest metal handling equipment.

According to Dan Hill, president, the present smelter will be closed after 53 years of continuous operation.

Scheduled for full operation by November 1, the new plant facilities also include a 6,000 square foot office, and a laboratory for melt and alloy quality control. The latter is equipped with spectrographic devices, raw material segregation areas, and ingot warehouse facilities.

Glidden purchases Magnetic Powders, Inc.

Magnetic Powders, Inc., manufacturer of iron powders, has been purchased by the Glidden Co. from Radio Cores, Inc. The new addition to Glidden's chain of metal powder plants will provide warehouse and production facilities to serve Glidden's market of industries around Johnsonburg, Pa. This market uses large quantities of metal powders, according to G. M. Halsey of Glidden.

Early this year, Glidden acquired a metal powders plant in Johnstown, which gave the company an entry into the ferrous metal powders field. The firm produces non-ferrous powders at a plant in Hammond, Indiana.

Magnesium Association to hold convention

The 17th Annual Convention of the Magnesium Association will be held October 16-18, it was announced by Ralph Ferguson, program committee chairman. The meeting will be held at the Belmont Plaza Hotel in New York City.

The theme of the Convention will be "Magnesium in Focus". The program will be devoted to papers discussing applications and technical developments pertinent to magnesium during the past year.

The major focal point, however, will be an Association-sponsored display of "101 Commercial Applications of Magnesium". It is hoped through this exhibit to spotlight the many unnoted applications common in everyday industrial, commercial and home life.

One entire session of the Convention will be devoted to a panel discussion of standards and specifications, which will represent the views of both the customer and supplier.

Arrangements can be made to display any magnesium products or parts without charge by writing or calling the Association offices at 122 East 42nd Street, New York 17, N.Y. OXford 7-2974.

more Industry News on page 96

ASM Metal Show to be held in Detroit in October

The 1961 Metal Show sponsored by the American Society for Metals will be held in Detroit's Cobo Hall during October 23-27.

Focal point of the show will be a Materials Comparison Center, where the properties of seven engineering material groups will be compared and evaluated. Sample parts, test specimens, and other exhibits will be displayed. For comparison purposes, materials will be classified as wrought ferrous, wrought non-ferrous, cast ferrous, cast non-ferrous, special purpose, non-metallic, or composite.

A technical program will run concurrently with presentations of the exhibit. Most technical sessions will take place in Cobo Hall meeting rooms adjacent to the exhibits. These sessions will feature the latest advances in engineering materials and materials processing covering everything from metal producing to atomic energy, including processing, testing, plastics, automobiles, aerospace vehicles, instruments, and many others.

General Bernard A. Schriever, the four-star "boss" of America's missile program, will deliver the keynote address at the 43rd Annual Banquet of the Society, which will be held in conjunction with the show.

TRIULZI

Novate (Milano)
Italy
Via Vialba. 56
Telephone 3 49 16 61/2/3/4
3 49 17 85/6/7/8
Telegraph: TRIULZIPRES
NOVATE
MILANESE

brings your attention to its latest achievement

castmatic 2500

the largest in the world!

DIE CASTING MACHINES

oil operated — automatic — fast cycling

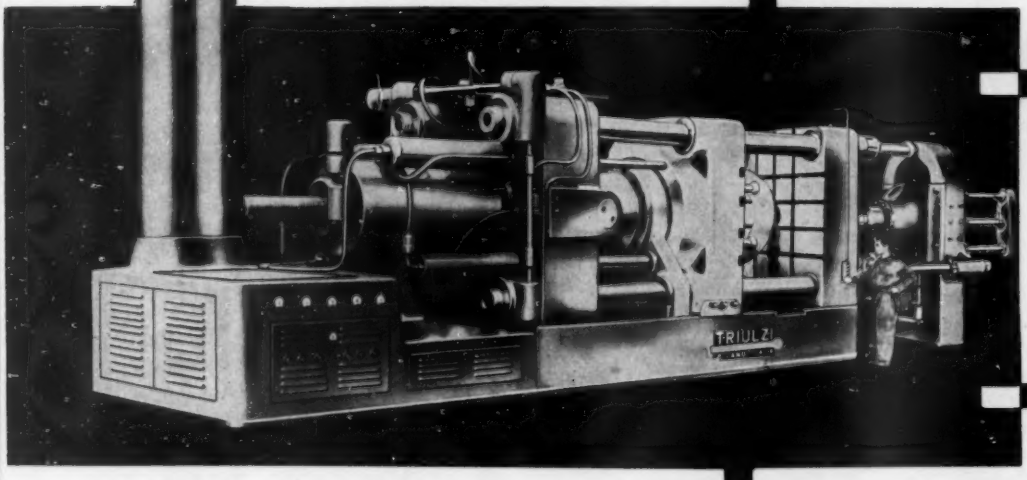
COLD CHAMBER

vertical and horizontal injection

and

HOT CHAMBER

from 35 to 2500 U.S. Tons



cold chamber CASTMATIC 2500
2500 U.S. tons LOCKING FORCE
positive clamping system by blocked piston
weight of the casting (Al. base) up to 130 lbs.

ALL CASTMATIC MACHINES
are normally fitted with:

- VICKERS hydraulics
- SIEMENS electrics
- automatic cycle equipment, with PROGRAM PRE-SELECTING PANEL

and can also be equipped with:

- DOSOMATIC: automatic dosing-filling furnace for cold-chamber machines
- VACUUM DIE CASTING device
- AUTOMATIC FORCED LUBRICATION of all mechanical parts
- OVERSIZE WATER HYDRAULIC PLANT for fast cycling
- DEVICE for the automatic control of the oil temperature
- TRIM press, oil operated, fast cycling—for trimming burrs and sprues

Visit us at:

ZAGREB FAIR—September 9-24, 1961
BRNO FAIR—September 10-24, 1961
7TH EUROPEAN MACHINE TOOL EXHIBITION
Bruxelles—September 3-12, 1961
Hall 4—Stand 4022

OUR STANDARD PRODUCTION:

- deep-drawing presses
- Arbor presses—Extruding presses
- Coining, gauging, hobbing presses
- HIGH PRESSURE HYDRAULIC PUMPS
- INJECTION MOULDING MACHINES FOR PLASTICS
  Models with preplasticizer: from 3 to 705 oz.
  without preplasticizer: from 3/4 to 28 oz.
- VERTICAL PRESSES FOR THERMOSETTING MATERIALS
- THERMOFORMING MACHINES FOR THERMO-PLASTIC LAMINATES
- BLOW MOULDING MACHINES FOR PLASTIC HOLLOW ITEMS
- SCREWS AND COMPLETE EXTRUDING PLANTS for making films, rigid and flexible profiles, hollow coatings, plastics coloring and granulation
- PRESSES for POLYESTERS and for PLASTIC LAMINATES
- RECORD MOULDING PRESSES
- SPECIAL PLANTS FOR PROCESSING PLASTICS

Circle 69 on Reader Service Card

HOUGHTON HYDRAULIC FLUIDS and PACKINGS

Here are tips to help you achieve packing-fluid compatibility!

The efficiency, safety and ultimate cost of a hydraulic system is largely dependent on the compatibility of its packings and fluid medium . . . how well they do or do not work together.

Mineral Oils

The above is frequently overlooked when a plant switches from one type of fluid to another. Take *mineral oils*, for example. Three general types are used in hydraulics, and are classified according to their aniline points: high, medium and low.

If, through error, a high aniline oil is used where low aniline oils are specified, rubber seals in the system would shrink and harden. Conversely, "high aniline" rubber seals will swell and soften in low aniline hydraulic oils. Leakage or equipment failure is the result.

To complicate the picture further, mineral oils made to the same specification by different oil manufacturers, using different crudes, will vary in aniline point to the degree that they may cause synthetic rubber seals to either shrink or swell.

Even among the various types of synthetic rubber used for hydraulic seals, the reactions to mineral oils vary. Buna S and Butyl seals, for example, will disintegrate in mineral oil while Buna N, Neoprene, Viton and Thiokol polymers work very well.

Fire-Resistant Fluids

In many hydraulic systems, *mineral oils* are being replaced by modern, synthetic fluids which eliminate fire hazards without affecting hydraulic efficiency.

Three types of fire-resistant fluids are in wide usage and each type requires a *compatible* packing.

The three basic types of synthetic fluids with *recommended* and *maximum recommended* operating temperatures are shown in the box.

Type	Recommended Temperature	Maximum Recommended Temperature
Phosphate Ester	+130°F.	+180°F.
Water-Glycol	120°	150°
Emulsion water-oil	120°	150°

Phosphate Ester fluids and mineral oils have a directly opposite effect on the same rubber seals. Butyl packings which fail miserably in mineral oils, work beautifully with straight Phosphate Ester while Buna N, which works well in mineral oils, is unsuitable for Phosphate Ester. For this reason, changing a system from mineral oil to Phosphate Ester requires a complete and careful flushing and cleaning *as well as a switch in packing materials*, if elastomer packings are used.

For use with these fluids, homogeneous packings should be of Butyl, fabricated packings of Butyl and duck or asbestos and leather packings should be either Wax or Thiokol impregnated.

Water-Glycol fluids are generally compatible with both Buna N and Butyl seals, and with duck or asbestos. However, they do attack leather fibers. Water-Glycols have a pH of 8.5 to 10.5 and leather fibers start to disintegrate at a pH over 8.0

Because of this pH condition, leather packings are not recommended for use with Water-Glycols. Homogeneous packings should be of Buna N and fabricated packings of either asbestos or duck and Buna N.

Emulsion type fluids react much the same as mineral oils do with rubber and leather. In homogeneous and fabricated packings, use Buna N; in leather, use a filler of wax or Thiokol. Never use Emulsion fluids with Butyl.

A Simple Solution

As complex as the subject appears, packing-fluid compatibility in hydraulic systems can be determined with very little trouble. Houghton Packing-Fluid Compatibility Tables will instantly tell you which packings work best with the various types of fluids in general use.

Better yet, Houghton is in a unique position to give you completely unbiased answers to your hydraulic packing-fluid problems, for **Houghton is the only manufacturer who offers you a complete line of both packings and fluids for industrial hydraulic systems.**

FREE! Packing-Fluid Compatibility Tables

For your copy of Houghton's Packing-Fluid Compatibility Table, or for help on any hydraulic packing or fluid problem, call your Houghton representative or write: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Houghton

INDUSTRY'S PARTNER IN PRODUCTION

Circle No. 39 on Reader Service Card

THE
FREEDOM
DI
MEN
SION

. . . stretches your design potential

Parts-design becomes as flexible as wax when you specify investment casting. With the "lost wax" process, parts may be designed for function...operating efficiency . . . and wearability. Costly machining and assembly operations are reduced and often eliminated. A wide variety of alloys offers better parts performance and cost reductions.

To discover the benefits Hitchiner Investment Casting can bring you...

write for complete technical and facilities information.

HITCHINER
Milford 4, New Hampshire
Circle No. 37 on Reader Service Card

PMM letters

the readers' forum

Machining data

The article "Copper-Base Extrusions" in your May 1961 issue has some very interesting machining and tool data tables. Are these original tables, or can I purchase a text for further study?

Our own product has very peculiar machining characteristics, so a table such as the one published is very valuable to us.—K.E.M., Industrial Engineer

The data presented in this article on machining and tool grinding was furnished to us by the Revere Copper and Brass Corp. All further available information can be secured at no charge from Revere.

Cast-in bushings

We are in the die casting business and are involved with several jobs which require the insertion of self-lubricating, powdered metal bushings by pressing. Has a technique been developed to insert the bearings into the die casting dies prior to making the casting?—F.E.

Casting-in porous bushings made from metal powders as inserts in die castings is quite common practice. The only precaution that must be observed is that the bushings must be completely free of oil when they are placed in the die casting machine as inserts.

In some cases the outside of the bearing carries longitudinal ribs to lock it in place and prevent turning in the casting. In other cases the natural porosity of the powdered metal material is sufficient for adequate locking.

If movement in a direction parallel to the axis of the bearing is a problem, a small flange molded onto the O.D. of the bushing or a groove cut in as a second operation will give adequate locking.

Other than this there should be no problem at all using these bushing as inserts in either zinc or aluminum die castings.

KOZMA
MELTING AND HOLDING
FURNACES

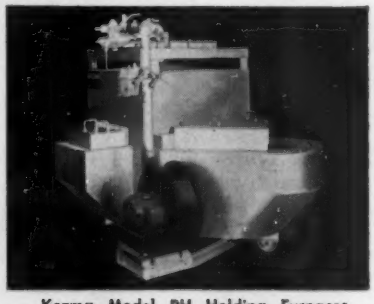
Kozma Melting and Holding Furnaces are being specified by die casters, permanent molders and aluminum producers . . . where highest quality metal is a "must."

TILT-TYPE
MELTING FURNACE

These new Kozma Furnaces for aluminum or magnesium melting combine all the advantages of Kozma exclusives . . . **Radiant-Panel firing, "Pre-Temp" hearth or flue, a special re-melt well, and functional tilting design.** Integral ladle suspension arms permit easy ladle removal.

Kozma Tilt-Type Furnaces provide faster melting rate, highest possible metal purity, increased fuel economy, lower melting costs. Capacities from 600 to 2,000 lbs. per hour.

HOLDING
FURNACE



Kozma Model RH Holding Furnaces are designed for use in die casting and permanent molding. Roller bearing wheels and a unique dipwell permit integral installation. Bath capacities and dipwells can be designed to meet your particular requirements.

Write today for complete information!

J. A. KOZMA Company
2471 WYOMING
DEARBORN, MICHIGAN
Industrial Processing Furnaces since 1928

Circle No. 81 on Reader Service Card

Wants numbering wheels

Do you know of anyone in the die casting field who makes numbering wheels? We would like to locate someone who has a basic die for casting the wheels in zinc with both ten and twelve numbers on the periphery. Diameter of the wheels should be approximately ¾".–C.C.A.

PMM would appreciate hearing from readers who can supply this reader with information concerning die cast numbering wheels.

Casting high-purity aluminum

We are working on a new product line for a client of ours, and we need information on the possibility of using high-purity aluminum castings for the anodizing of light pastel colors.

Can this be done either with die casting or investment casting? If so, what casting companies could you recommend that cast high-purity aluminum successfully.–O.C.J.

The only company that we know of that has had experience in the casting of high purity aluminum and subsequent anodizing is the Nelmor Manufacturing Co., 26420 Lakeland Blvd., Cleveland, Ohio.

Glascast Process

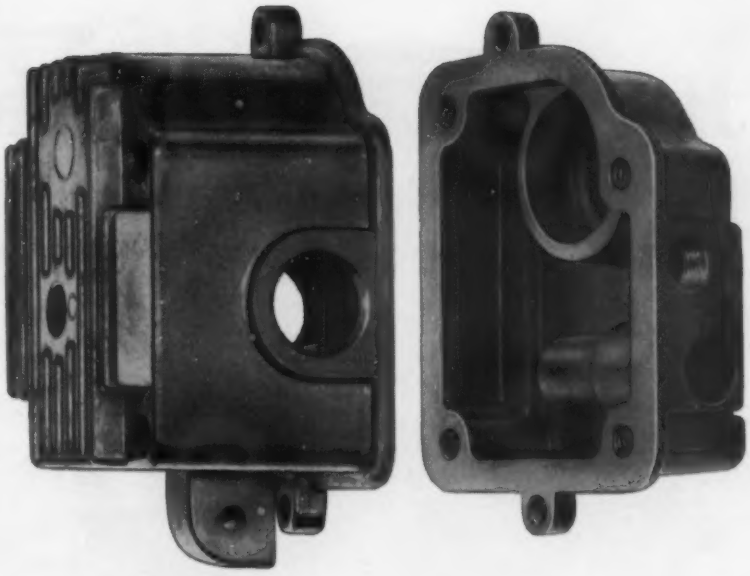
We are trying to locate the proper division of Corning which holds the rights to, or supplies the materials for the "Glascast Process" described on pages 40 and 41 of your January '61 issue. We would appreciate any information available on the process.–H.R.

We suggest this reader contact Mr. Edmund Baker at the Corning Glass Works in Corning, New York for further information.

Die Casting References

Would you kindly recommend several reference books on the techniques of die casting?–S. K.

We recommend "Die Casting" by Herman Doehler, published by McGraw-Hill, and "Die Casting" by Herb, published by Industrial Press.



Which came first, the process or the part?

When you see a die casting like this you just about have to ask yourself . . . "Did the production process make the part possible, or did design dictate the process?"

Part-wise this gear box demands precision, strength, heat dissipation, maximum elimination of post-casting machining. It is integral and functional to the power mower for which it was built. Did design dictate die casting?

Process-wise, the shape couldn't have existed with such close tolerances, with such variable shapes without die casting. No known method of parts production could produce the part at such low unit cost and maintain requirements.

Perhaps this is the way to look at it: Good part design and good die casting *combine* for superior results. Since 1919, Twin City Die Castings has aimed its complete plant facilities to achieve this end.

...only DIE CASTING can
✔ cut your costs ✔ offer such flexibility
✔ provide such accuracy

Leading Die Casters in the Upper Midwest

TWIN CITY DIE CASTINGS CO.

3351 TALMAGE AVE. S. E. • MINNEAPOLIS 14, MINN. • PHONE MI 6-7528

RESEARCH PARTICIPANT

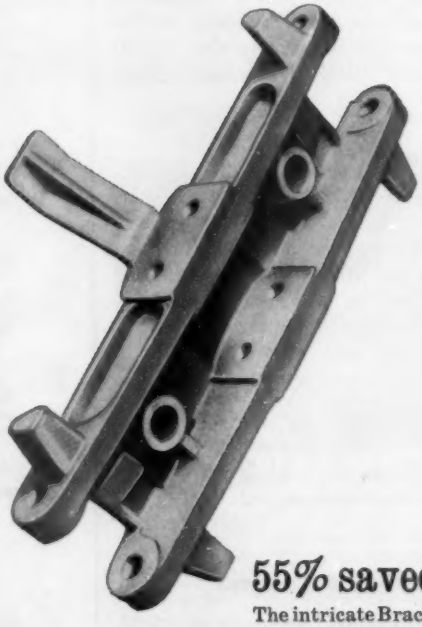
Circle No. 89 on Reader Service Card

Senufo mask from the African Ivory Coast, cast in bronze. Courtesy of The Museum of Primitive Art, New York City.

... an ancient art cuts costs for MODERN INDUSTRY!

In man's conquest of metal, one of the great technical advances was the ancient art of "lost wax" casting. That art, today known as "investment casting", has become a precision technique that is cutting costs for modern industry. It is the most economical method for casting intricate precision parts and sub-assemblies in most ferrous and nonferrous alloys.

We would welcome the opportunity of having our representative call on you . . . and we invite you to submit prints for an estimate.



55% saved!

The intricate Bracket shown here, investment cast in steel to close tolerances, has inherent structural strength with minimum weight. Production costs were more than halved!

INVESTMENT CASTING CO.

Subsidiary of Faradyne Electronics Corp.
60-A Brown Avenue, Springfield, N. J.

INVESTMENT CASTING

Circle No. 10 on Reader Service Card

SILICONE NEWS from Dow Corning

A Complete Shell-Out!

Silicones Help Shell Molders Stop Sticking, Speed Production

Don't let sticking slow your shell-mold production . . . nor step up scrap, or delay production schedules. Shelve your sticky problems permanently by using Dow Corning 8 Emulsion. Assure yourself of clean, easy release, retention of detail and maintenance of close tolerances.

Just a light coating of 8 Emulsion on patterns gives instant release of resin-sand shells and cores. You eliminate stickers and reduce expensive mold maintenance and replacement.

The silicone release coating obtained with Dow Corning 8 Emulsion resists heat . . . doesn't flash off or evaporate at mold curing temperatures . . . doesn't carbonize. Build-up on patterns is kept to an absolute minimum. Patterns stay clean many cycles longer — you may even find fewer are needed.

Easy does it. Simply mix Dow Corning 8 Emulsion with water . . . in the ratio most suitable for your process and in the volume most practical for your production schedule. Then, apply the mix by dip, brush or spray. The emulsion's stability and fast wetting action produce a uniform film that gives overall, easy release and provides excellent surface finish.

Technical service . . . fast delivery . . . lowest price! Dow Corning's constant research and development in silicone chemistry means our customers receive the newest and the best possible silicone products at lowest price. Phone or write the Dow Corning office nearest you for prompt technical assistance, or for fast delivery from warehouse stocks.

Write for "how-to-do-it" manual describing use of silicone parting agents in shell-molding. Address Dept. 4521

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Circle No. **29** on Reader Service Card

REED-PRENTICE

DIE CASTING NEWSLETTER

AUTOMATIC OPERATION ...what's in it for you?

Up until now, automatic operation in die casting has been largely limited to the smaller (100-200-ton) high-speed machines. While ideally suited to the very long production runs found in the automotive and appliance industries, automatic equipment does lack the flexibility for ready adaptation to a variety of jobs, and often requires more complicated dies.

However, the advantages it offers far outweigh these considerations. Automatic operation gives you the same conditions on every shot. Your operating cycle is shortened; your efficiency improved. And, once set and running, one man can tend several machines, with a resultant saving in labor costs.

What Is Involved?

Automation . . . automatic die casting . . . requires four key points.

(1) The machine must be equipped with a method of low pressure die closing. This is a vital safety factor, and protects the mold if a piece of the casting should not be completely ejected.

(2) Some form of automatic sweeping is needed between shots. This will blow off the die faces after opening to remove pieces, chips, etc. It can also be used to spray lubricant over the face on its return stroke.

(3) The die caster must be designed for automatic cycling with its gate closed.

(4) A method must be provided for removing pieces from the machine area.

What's New?

With many die casters showing an increasing interest in automatic operation, the question of "What's New?" comes up again and again. Reed-Prentice engineers have some surprising answers to this question . . . in 400-ton hot and cold chamber machines designed to handle completely automatic operation or any degree of it.

Each REED will be completely equipped to operate with automatic ladling, lubrication of die and plunger, program coring, and ejection. A newly designed drop-through base will permit castings to fall clear and enable users to hook up to an automatic conveyor system.

Speed and Capacity

These units will have faster die strokes, high operating pressures and short cycles. Both motor horsepower and pumping capacity are stepped up to handle the operating speed. Pipes will be sized to take the volume needed, and manifolded wherever possible.

Past performance of the REED crosshead and link system in numerous field installations shows that it gives the positive mechanical locking pressure needed for automatic operation and is easy to maintain. This system will be kept on the new machines.

No More Guesswork

One very important feature of these new units will be the accuracy of adjustment that will be possible. No more guesswork will be involved. On the shot end, you will be able to adjust hydraulic pressure, slow starts, fast fill and high squeeze. These same adjustments may be reset day after day, with the same degree of accuracy.

Die plates are being laid out with SDCE standards. The knockout pins are SDCE pattern, plus a generous carry-over of the old pattern. Thus any die presently being operated on a REED will be good on the new machine, too.

On the zinc machine, an automatic gas shut-off mechanism will be available as an option. This safety feature will operate if the flame goes out.

More Information

These are some of the major features die casters can expect to find in the new REEDs that are now available. If you'd like to know more, just contact your REED Sales Engineer. He can tell you about other advantages of the new 400-ton hot and cold chamber units, and about their use for automatic die casting.

In addition, he'll have some early development news on a new 600-ton REED, also built with an eye to automatic operation, which is scheduled for introduction soon. Why not call him today, or write us direct for information.

REED-PRENTICE

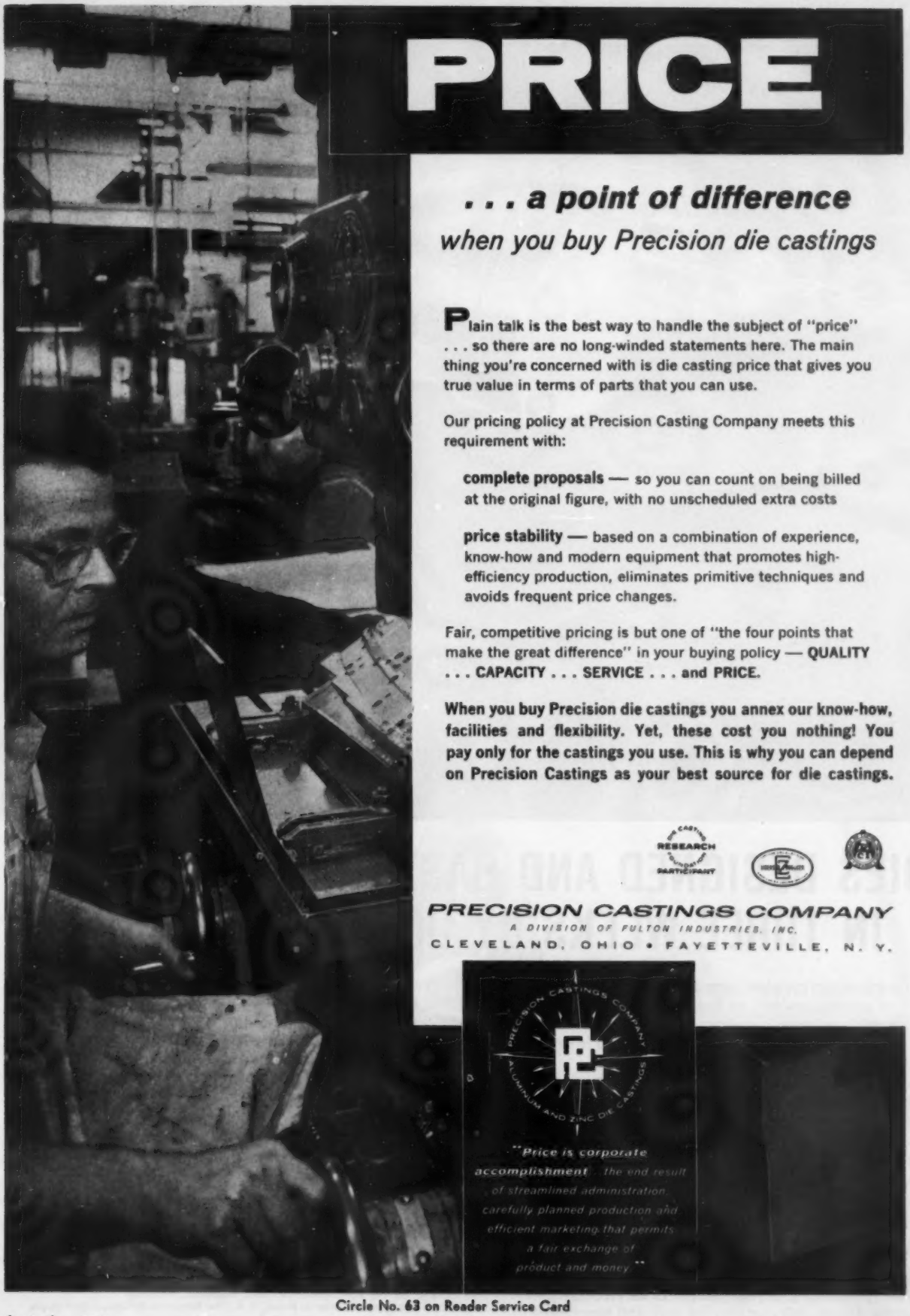
.....division of

EAST LONGMEADOW, MASSACHUSETTS

PACKAGE MACHINERY COMPANY

BRANCH OFFICES: NEW YORK • CHICAGO • BUFFALO • CLEVELAND • DETROIT • KANSAS CITY • LOS ANGELES

Circle No. 64 on Reader Service Card



PRICE

. . . a point of difference

when you buy Precision die castings

Plain talk is the best way to handle the subject of "price" . . . so there are no long-winded statements here. The main thing you're concerned with is die casting price that gives you true value in terms of parts that you can use.

Our pricing policy at Precision Casting Company meets this requirement with:

complete proposals — so you can count on being billed at the original figure, with no unscheduled extra costs

price stability — based on a combination of experience, know-how and modern equipment that promotes high-efficiency production, eliminates primitive techniques and avoids frequent price changes.

Fair, competitive pricing is but one of "the four points that make the great difference" in your buying policy — **QUALITY . . . CAPACITY . . . SERVICE . . . and PRICE.**

When you buy Precision die castings you annex our know-how, facilities and flexibility. Yet, these cost you nothing! You pay only for the castings you use. This is why you can depend on Precision Castings as your best source for die castings.

RESEARCH PARTICIPANT

PRECISION CASTINGS COMPANY

A DIVISION OF FULTON INDUSTRIES, INC.

CLEVELAND, OHIO • FAYETTEVILLE, N. Y.

PRECISION CASTINGS COMPANY — ALUMINUM AND ZINC DIE CASTINGS

"Price is corporate accomplishment . . . the end result of streamlined administration, carefully planned production and efficient marketing that permits a fair exchange of product and money."

Circle No. 63 on Reader Service Card

TEAMWORK BEATS SCHEDULE
IN MARKETING FIRST CORDLESS DRILL

DIES DESIGNED AND CASTINGS DELIVERED IN THREE WEEKS BY DOEHLER-JARVIS!

A 'breakthrough' product means a race against time. Get it in production and on the market while it is still "hot" news.

That was the situation Black and Decker faced in developing the first "cordless" electric drill.

A major time factor—the design and construction of dies and the die casting of three major elements of the revolutionary new product.

The question put to Doehler-Jarvis—can you design and build the dies and deliver aluminum castings for the gear case, gear case cover and field case in three weeks?

The answer—we did it!

The first delivery of completed castings was made in three days less than three weeks.

This is *not* a routine situation. But it is an outstanding example of how Doehler-Jarvis' 57 years of leadership in die casting can work to your benefit in all circumstances. It was the design and engineering skill and experience of Doehler-Jarvis, together with their unmatched production facilities and know-how which helped Black and Decker meet its ultra-tight production schedule.

But there was more to gain than speed. The die cast parts delivered to Black and Decker have the high strength, impact resistance and abrasion resistance needed to take rough handling; they are sound and dimensionally stable to permit and maintain close tolerance; and their attractive finish adds extra sales value.

You will find it to your advantage to talk to Doehler-Jarvis about die castings for your products. Contact the office nearest you.

Doehler-Jarvis

Division of National Lead Company • General Offices: Toledo 1, Ohio
Plants and Sales Offices: Toledo, Ohio; Grand Rapids, Michigan; Pottstown, Pennsylvania; Batavia, New York.
In Canada: Barber Die Casting Co., Ltd., Hamilton, Ontario.
In Brazil: Industrias Doehler do Brasil, S. A., Sao Bernardo do Campo, Sao Paulo.
In Argentina: Doehler Argentina, S. A., Buenos Aires.
In Great Britain: Metal Castings-Doehler, Ltd., Worcester, England.

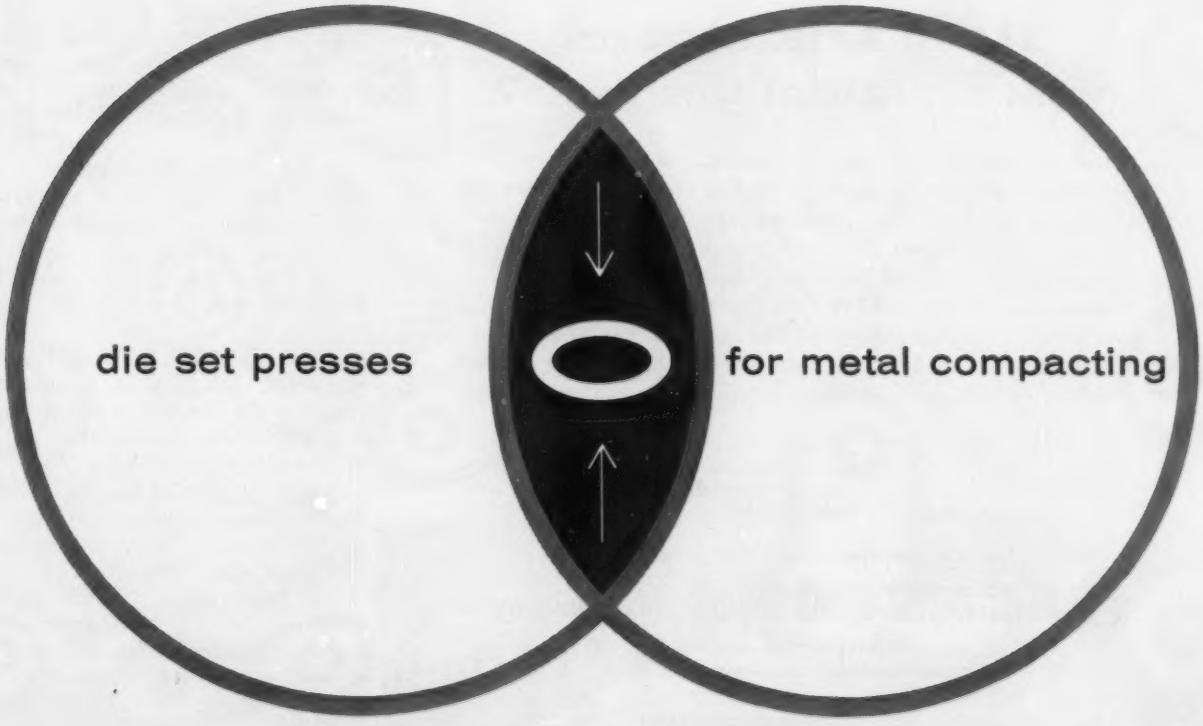
Circle No. 93 on Reader Service Card

STOKES brings the proved precision of die set construction to powder metal compacting! Specifically designed for the manufacture of products demanding extremely high dimensional precision, these die set presses provide the accuracy and guidance required to operate tooling with punch and die clearance as fine as .0001". Die set construction makes setups and adjustments a snap. The complete die set can be removed from the press, the necessary tool changes made, and returned to the press in minutes. And for extra-long wear, all operating parts are made of hardened tool steel.

This new line of die set presses ranges from ½ ton to 100 tons. Presses include all the automatic and high-speed features . . . plus the attention to engineering details that have made Stokes presses famous throughout the world for more than 60 years.

Get all the news on these and other Stokes powder metal presses by contacting your nearest Stokes representative. Powder Metal Press Division, F. J. Stokes Corporation, 5500 Tabor Road, Philadelphia 20, Pennsylvania.

PRECISION



Put STOKES 50 years of compacting experience to work for YOU!

Circle No. 66 on Reader Service Card

DISPERSION QUALITY IS ACHESON

Paint a parking lot with colloidal graphite?

Maybe not practical . . . but very possible. A pound of colloidal graphite contained in 'Aquadag'® is capable of coating a surface area of over half an acre! Under similar circumstances 325 mesh graphite will hardly cover the area of a two car garage. Increased film coverage enables Acheson to supply both quality as well as greater economy in its dispersions. IT'S A MATTER OF COST PER AREA OR APPLICATION RATHER THAN COST PER POUND! Engineering note: Acheson dispersions provide a thinner film which does not affect tolerances . . . a distinct advantage in many industrial applications.

To learn more about the unique advantages of Acheson dispersions as they apply to your lubricating problems, write Dept. PMM91.

ACHESON—First name in solid lubricants for fifty-three years.

ACHESON Colloids Company

PORT HURON, MICHIGAN

A division of Acheson Industries, Inc.

Sales offices in principal cities.

Also Acheson Industries (Europe) Ltd. and affiliates, London, England

Circle No. 1 on Reader Service Card

PMM

book reviews

Engineered Castings, *Glenn J. Cook; McGraw-Hill Book Co., New York,* 1961. 240 *pages.* $8.50

This is one of those rare books which should be of some value to practically anyone connected with the metal casting industry. Although by no means a "bible" for the field, the book does provide a broad review of good practices concerning the design, production, and buying of metal castings. Emphasis is placed on casting use, rather than production.

Designers will find the design pointers a convenient review of sound casting design principles. Brief descriptions of production practices should interest those who want to know a little more about what happens out in the shop. Production men should find the non-technical presentation of design information helpful in broadening their knowledge of the industry.

Detailed information tells how to obtain quotations and order castings. The author is manager of marketing for the Foundry Department of General Electric Co.

United States Air Force Machinability Report — Titanium, *James Van Voast; Curtis-Wright Corporation, Wood-Ridge, New Jersey, 1960. 153 pages.*

This book is part of the Air Force sponsored program of industrial planning for defense mobilization. The contents are intended to provide production planners with a means of estimating machine tool needs, power requirements, cost, and productivity data concerning the machining of titanium.

The book makes recommendations concerning tool selection, speed, feed, tool angles, and types of cutting fluids for the major machining Surface finish factors are also discussed.

more Book Reviews on page 43

Low-cost answer to hydraulic fluid safety...
UCON Fire-Resistant Hydrolubes

ARE you running the risk of being burned out of business by a sudden hydraulic line break that sprays flammable fluid into a hot and hazardous area?

The dangers of such a fire can be virtually eliminated by converting to fire-resistant UCON hydrolubes. This has been proved by exhaustive field tests and more than 14 years of routine use in industrial hydraulic systems.

UCON hydrolubes are balanced formulations of a water-soluble polyglycol thickener in an ethylene glycol-water base. Selected additives keep pump replacement costs low and provide maximum liquid and vapor-phase corrosion resistance. As long as water content is adequately maintained, UCON hydrolubes give complete protection from flash fires; they also have successfully passed 100 per cent oxygen atmosphere spray flammability tests.

UCON hydrolubes come in viscosity grades to meet all system needs and operating conditions. Their viscosity-temperature properties are better than those of other types of fire-resistant fluids and petroleum oils.

Conversion from flammable petroleum oils or non-aqueous fire-resistant fluids to fire-resistant UCON hydrolubes is quick and easy. No special packings and seals are required. In many instances, leakage loss is reduced.

For complete information on the economy and efficiency of UCON safety hydraulic fluids, and the simple conversion steps for your systems, call your CARBIDE Technical Representative, or write: Union Carbide Chemicals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.

UNION CARBIDE CHEMICALS COMPANY

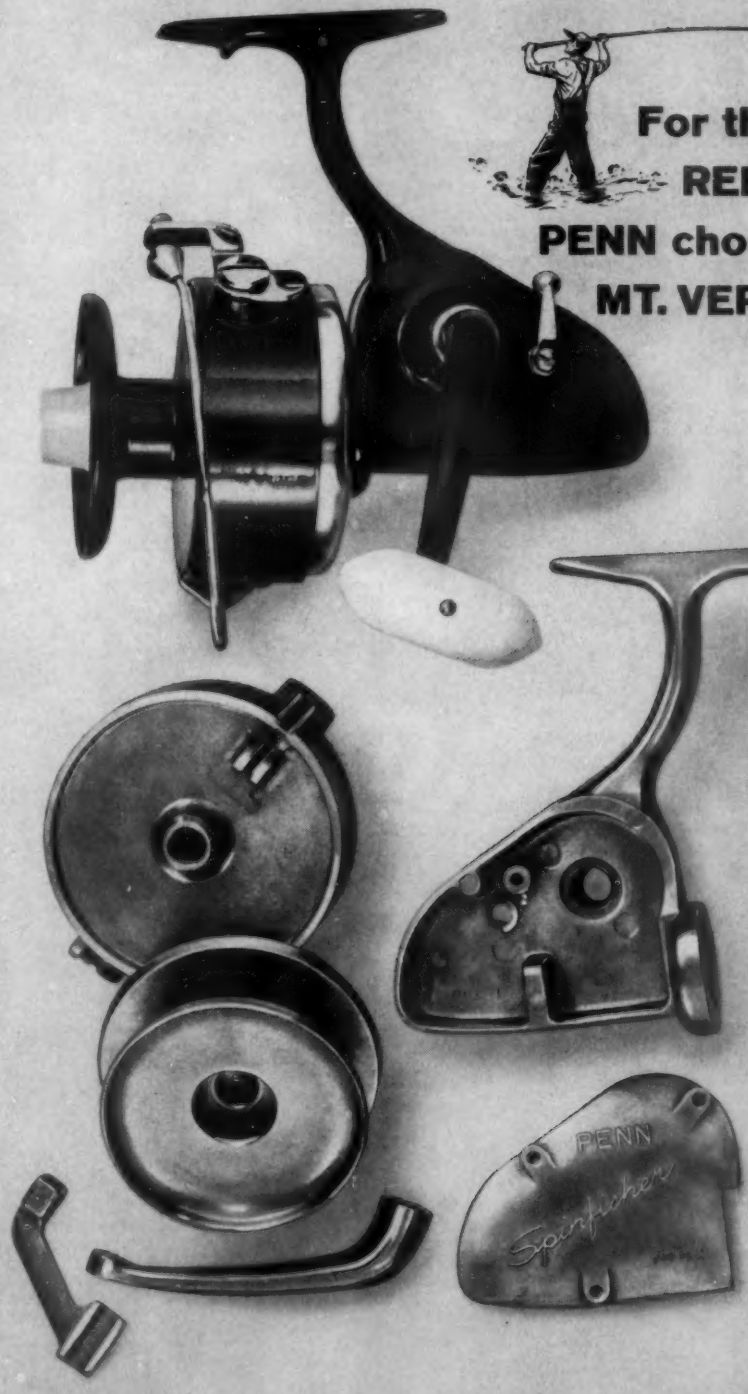
UNION CARBIDE

Circle No. 87

UCON and UNION CARBIDE are registered trade marks.

CASE HISTORIES FROM
MT. VERNON FILES

For their newest REEL of CHAMPIONS PENN chooses die castings— MT. VERNON die castings



Like other Penn "Reels of Champions," this new Penn Saltwater Spinfisher 700 will enjoy ready acceptance among both dealers and fishermen. It has 18 features—some exclusively Penn—which make it durable, corrosion resistant and simple to service.

3:8 to 1 gear ratio for fast retrieve—stainless steel gears and ball bearings—high-nickel stainless steel parts—automatic bail lock—250 yd. capacity spools—epoxy finished aluminum housings for strength—weight only 20½ ozs.—are some of its outstanding features.

Seven lightweight, aluminum castings (you get 2 one-piece spools complete with drag disk assembly) go into its construction. Quite a few castings—all precision, and several complex at that.

Aluminum die casting was the only feasible method for manufacturing such a champion—to hold down weight and cost and yet satisfy Penn's traditionally high standards of craftsmanship.

To Mt. Vernon went the honor of making the castings, because Mt. Vernon—like Penn—also enjoys a reputation for high standards of workmanship. At Mt. Vernon you gain through a fourfold service embracing: Designing • Die Making • Casting • Machining—all under one roof in 200,000 sq. ft. of space.

You, too, can set your standards as high as you wish—then confidently give your specifications to Mt. Vernon and relax. You'll get champion castings. A call to your nearest Mt. Vernon field salesman or our home office will get you prompt action.

MT. VERNON DIE CASTING CORPORATION

Stamford, Connecticut

FIELD SALESMEN—BALTIMORE, MD.: Mr. C. M. Gordan, 919 St. Paul St. • **BROOKLYN, N. Y.:** Mr. Robert V. Moore, 2317 Plumb 2nd St. • **MARIETTA, N. Y.:** Mr. Burt J. Meldrum, Olanco Road • **PITTSBURGH, PA.:** Mr. Andrew W. Anderson, 300 Pasadena Drive So. • **STAMFORD, CONN.:** Mr. Anker Anderson, Cascade Road • **VALLEY FORGE, PA.:** Mr. G. T. McMaster, P. O. Box 115

Circle No. **52** on Reader Service Card

Continued from page 40

The Elevated Temperature Properties of Aluminum and Magnesium Alloys, *American Society for Testing Materials. Philadelphia, 1960. 308 pages. $7.00*

This is an ASTM Special Technical Publication on the tensile and creep-rupture properties of current, commercially established, aluminum and magnesium alloys normally used at high temperatures. Wrought and cast alloys in various forms are covered. A few alloys not normally considered high-temperature alloys are included for comparison purposes.

Data sheets for each alloy give a description of the material and strength values.

The Encyclopedia of Spectroscopy, *Edited by George L. Clark; Reinhold Publishing Corp. New York, 1960. 787 pages. $25.00*

This book, a companion piece to the Encyclopedia of Chemistry, is an authoritative review of the field of spectroscopy. Major attention is paid to the use of this science in metallurgy and chemical anaylsis. The industrial applications of spectroscopy in research, routine testing, and on-stream control are included.

The book also covers optical masers and the Mossbauer effect. It is designed to meet the needs of everyone who has recourse to spectroscopy.

Contemporary Problems of Metallurgy, *Edited by A. M. Samarin; Consultants Bureau Enterprises, Inc., New York,* 1960. 538 *pages.* $16.00

This translation from the Russian work offers a comprehensive review of the most significant research and industrial applications in the field of Soviet metallurgy. Most of the book deals with the production of steel and pig iron. However, major attention is also given to heat resistant, austentic, and stainless steels, including data on various heat treatments and their effects on steel structures.

Many tables, diagrams and drawings illustrate the text.

more Book Reviews on page 49

Circle No. 70 on Reader Service Card

Hot-Work Tool Steels

For Every Need

When you need Hot-Work Tool Steels, for standard or severe applications, turn to UDDEHOLM for a superior Swedish quality to satisfy your most exacting requirements. Our mills in Sweden produce grades that have exceptional toughness, will retain high hot-hardness and resist heat-checking, to give long production runs.

Specify these grades for economy with UDDEHOLM Swedish Quality!

For Brass and other high-temperature alloy Die Casting, Hot Press Forging and Hot Extrusion Dies — UDDEHOLM'S exclusive **UHB CALDUR** • **UHB CALMAX**
For Aluminum, Magnesium, long-run Zinc Die Casting — **UHB ORVAR** — SAE H-13
For Aluminum Hot Extrusion Operations — **UHB SPECIAL** — SAE H-12
For Zinc Die Casting — Cold Hobbed Dies — **UHB PREMO** — SAE P-4

UDDEHOLM Tool Steel Service Centers stock
the grade, size and shape of Hot Work or Cold Work tool steels you need — ready for prompt delivery to you!

Send for Technical information and stock list on any grade you require.

UDDEHOLM CO. OF AMERICA

UHB TOOL & DIE STEELS COLD ROLLED SPRING STEELS

155 East 44th St., New York 17, N. Y., MUrray Hill 7-4575

Uddeholm Steels—used by American Industry since 1820

Branch Offices & Warehouses — Chicago, Ill. — Cleveland, O. — Detroit, Mich. — Los Angeles, Calif. — Newington, Conn. — Philadelphia, Pa. — In Canada — Uddeholm (Canada) Ltd., Montreal — Toronto

another unique **GRC die cast** zinc alloy component

this movable Intercast® element unit was **cast-assembled in one operation by GRC**

GRC's unique patented INTERCAST method die casts multiple-part zinc-alloy units with moving elements in a single, automatic, time saving, money-saving operation . . . even continuously interlocked assemblies. Units leave the machine complete . . . no trimming, no assembly, no machining needed. This INTERCAST technique is an ingenious refinement of GRC's exclusive method of small parts die casting—providing broad design latitude, close tolerances, economies in quantities of 100,000 and more.

Let GRC solve your problems. No size too small. Maximum length 2", maximum weight: ½ oz. ***Send TODAY for samples, prices and fact-filled bulletin.***

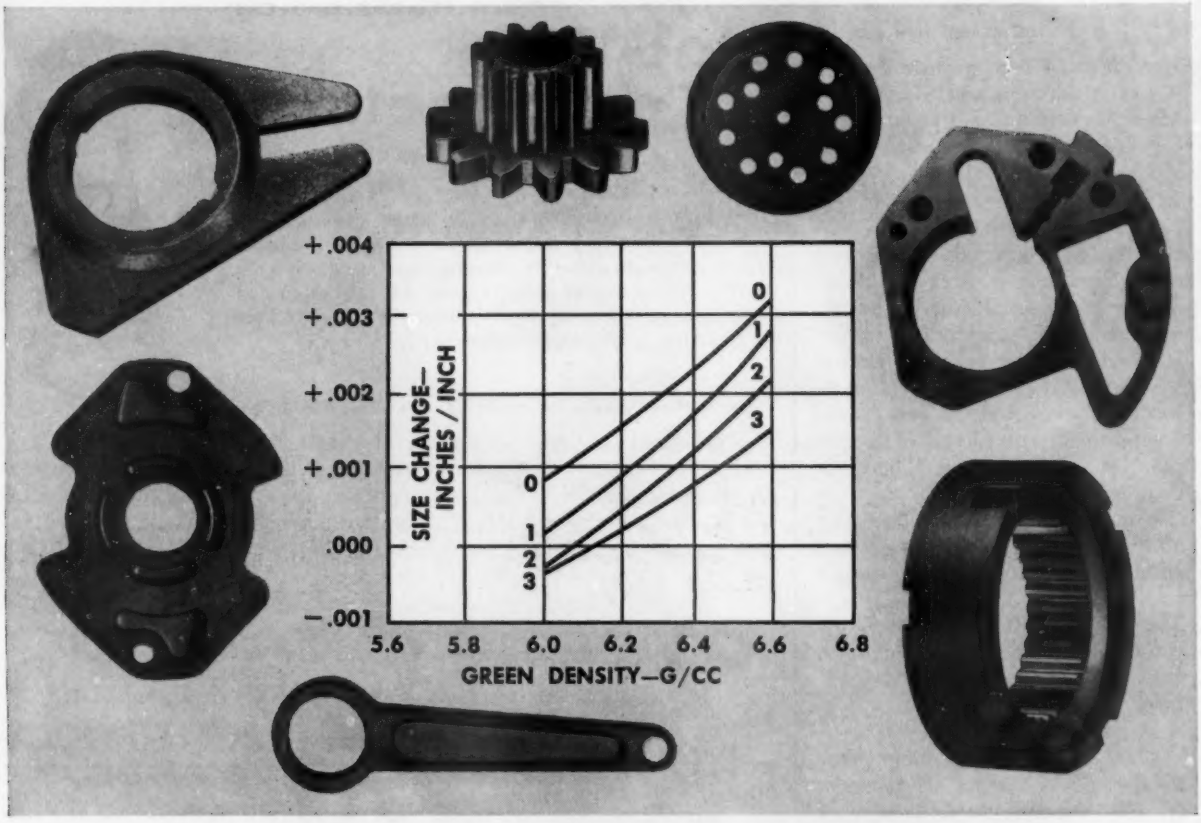
World's Foremost Producer of Small Die Castings

GRIES

GRIES REPRODUCER CORP.

157 Beechwood Ave., New Rochelle, New York • NEw Rochelle 3-8600

Circle No. 34 on Reader Service Card



Better dimensional control, with economy ...when you use A.W. Iron Powder

Little differences in the carbon additive to A.W. Iron Powder can make big savings in your plant.

By use of different types of carbon additives, in iron-copper-carbon mixes, a broad range of dimensional control can be achieved. This provides not only greater latitude in design specifications, but prolongs the service life of your dies. Together, these advantages result in closer tolerances for your molded parts at reduced production costs.

The curves shown above indicate the range of dimensional change obtainable with various types of carbon. *The cost of all these grades is almost identical.*

The Alan Wood 50-ton-a-day direct reduction plant, backed by years of metallurgical research, offers you the most advanced technology in Iron Powder. Make Alan Wood your Iron Powder headquarters for dependable uniformity and delivery, as well as technical advisory service.

ALAN WOOD STEEL COMPANY

CONSHOHOCKEN, PA.

FOR MORE INFORMATION

IRON POWDER DIVISION
ALAN WOOD STEEL COMPANY
Conshohocken, Pa.

Please send me A.W. Technical Data Bulletin #3, which gives additional details on copper-carbon additives.

NAME AND TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

AMERICAN STEELMASTERS FOR 135 YEARS

Circle No. 2 on Reader Service Card

Diecasting with EMB

bigger output — less cost

Compressed air at 150 lbs./sq. in. gives high speed which is controllable by a self-contained hydraulic system.

Quick acting valves pilot operated.

Controls very sensitive — hand operated for setting up, automatic for production.

Zinc furnace fired by coal gas, natural gas or oil.

Machines can be serviced by any good mechanic — no electrics are used.

Takes only 2 hours to convert from hot chamber to cold chamber.

Units completely interchangeable.

MACHINE SIZE	No. 10	No. 12A
Wt. per shot zinc base lbs	2¾	6.3
Wt. per shot aluminum lbs	1¼	2.1
Max. die	16" x 10"	20" x 12½"
Platen stroke	6"	8"

Larger sizes available

E. M. B. Co. Ltd.

WEST BROMWICH • ENGLAND

EMB No. 10 Automatic Diecaster for Zinc

Circle No. 31 on Reader Service Card

"Our Di-Profiler paid for itself in less than 3 months"... says Admiral Die Castings, Chicago

Illustration shows diamond file reciprocated by the Di-Profiler operating at 75 strokes per second, with stroke length of 3/16". Tool is finishing detail on ejection half of die for upper guard of portable electric saw.

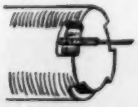
THE Di-Profiler
RECIPROCATING HAND MACHINE

for time-saving, precision die making and maintenance

Use the Di-Profiler for die shapes like these

CONCAVE AND CONVEX SURFACES

DEEP TAPERED CAVITIES



SHOULDERS AND RECESSES

INTRICATE DIES

CORNERS, SMALL AREAS, GROOVES, FINE DETAILS

In the die shop of Admiral Die Castings, Chicago, (division of Portable Electric Tools, Inc.) and in scores of other die shops, the Di-Profiler has paid for its moderate cost many times over in man hours saved and in increased accuracy of castings.

For die making and die maintenance—for all draw filing operations, cavities, core pins and those hard-to-reach details—the Di-Profiler is indispensable.

The Di-Profiler is driven by a flexible shaft; it is light, sturdy, free from vibration. The reciprocating speed, controlled by foot rheostat, is variable from 0 to 100 strokes per second; the stroke length is adjustable from 0 to 1/4".

Di-Profiler accessories for every contour

... Diamond and Swiss files, flat and riffle; hones and T-C scrapers; also, for use with the Di-Profiler rotary hand piece: diamond wheels, points and T-C burrs.

Ask for a free demonstration or illustrated Price List DV-91

HYPREZ DIVISION
ENGIS EQUIPMENT COMPANY
431 SOUTH DEARBORN STREET, CHICAGO 5, ILLINOIS
Sole authorized distributor for the United States

Circle No. 91 on Reader Service Card

Versatility and low cost make Zinc superior metal for die casting

Versatility and low cost are two key reasons for die casting with zinc. Characteristics like good dimensional stability, close casting tolerances, high strength-to-weight ratio, excellent finish, point up the metal's versatility. Initially a low cost metal, zinc's low melting point makes possible further cost savings with longer die life and faster press operation. In addition, smooth "as cast" surfaces mean minimum finishing cost.

BUY

TADANAC

SPECIAL HIGH GRADE ZINC

TADANAC Brand Special High Grade Zinc, electrolytically refined under carefully controlled conditions, has the overall purity and the low individual impurity content (determined spectrographically) to ensure it is completely satisfactory for die cast alloy manufacture.

DELIVERY – UNIFORMITY – SERVICE

From a single refinery Cominco produces over 500 tons of zinc a day. This assures our customers consistent, prompt delivery of metal of uniform high quality.

Our Technical Service is ready at all times to assist you to use TADANAC zinc to your best advantage.

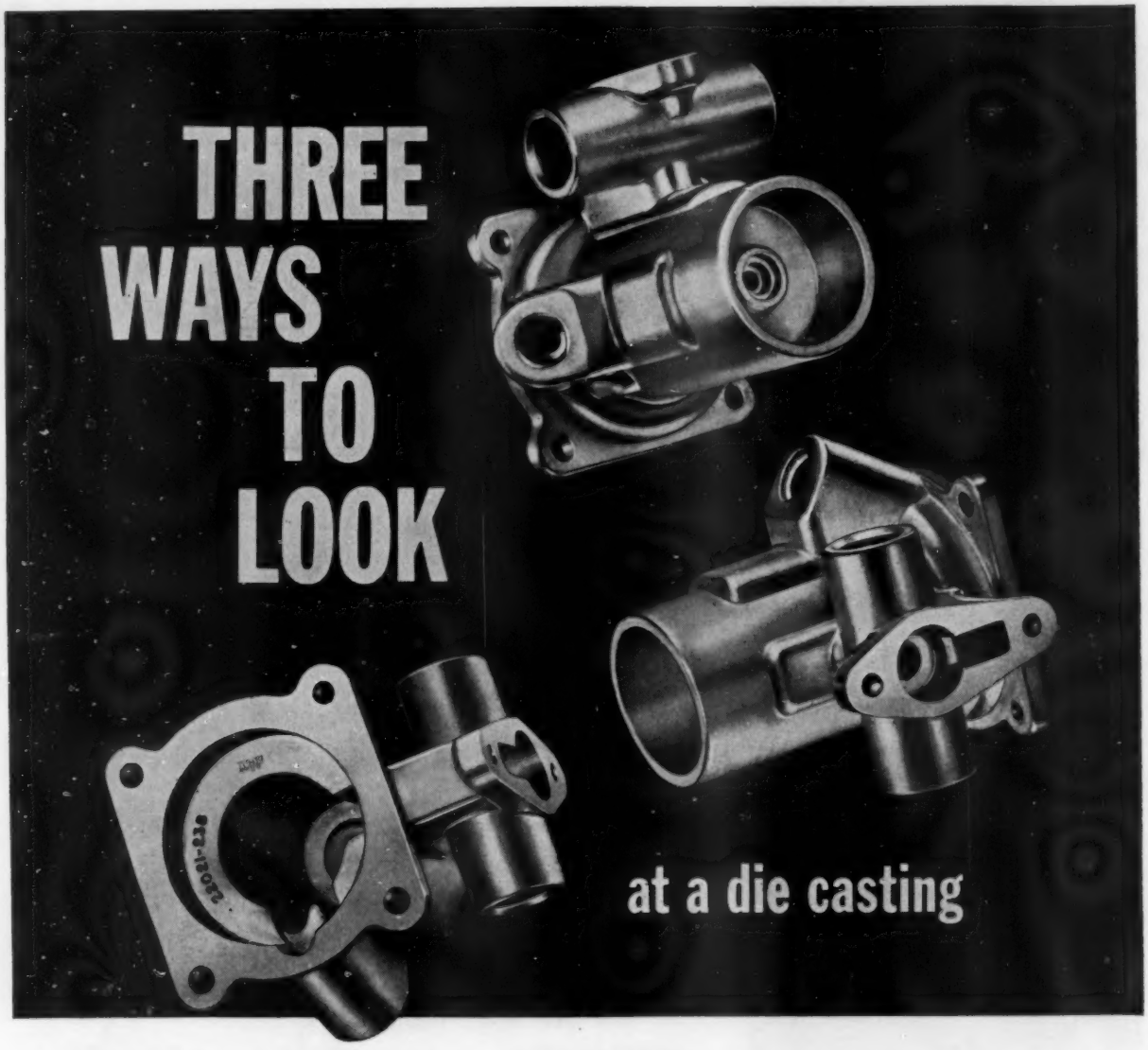
TADANAC SHG *FOR DIE CAST QUALITY*

COMINCO

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED, MONTREAL

Tadanac Brand Metals are sold in United States by American Metal Climax, Inc., New York, Chicago, Detroit, Los Angeles

Circle No. 20 on Reader Service Card



Madison-Kipp zinc and aluminum die castings

Here is a gas valve housing so intricate no one view could do it justice. Notice that the holes which are cast in reduce secondary operations. Cast in seats must be smooth and flat to prevent any danger of leakage. Dimensions must be held to close tolerances.

There are three ways to look at a die casting. First, the engineering that goes into the design and the skilled die making that assures perfect castings. Second, the experience of the die caster that guarantees quality parts in quantity. Third, his reliability and responsibility backed by years of die casting experience.

On all three counts—engineering, production, responsibility—Madison-Kipp has won the confidence of manufacturers who demand the finest.

We have a 24-page book showing some of the die casting problems we have solved, and containing information on other Madison-Kipp products. A copy is yours for the asking. Write for one.

kipp

MADISON-KIPP CORPORATION

213 Waubesa Street • Madison 10, Wisconsin, U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High-Speed Air Tools

Circle No. 47 on Reader Service Card

HARDENED STEEL
DIE CASTING
PLUNGER RINGS
by
AUTO
DIESEL

1" dia. x ⅛"
and up

Cut die cast production costs—reduce downtime with rings made by the world's quality ring manufacturer. The hardened steel ring illustrated is resistant to heat and abrasion. Other Auto Diesel products custom manufactured to your specific requirements.

1. Rings of all materials for industrial purposes.
2. Plungers for zinc.
3. Plunger tips and rings for aluminum.

Try it Today . . . . You'll Standardize Tomorrow

THE AUTO-DIESEL PISTON RING CO.
3141 Superior Avenue • Cleveland 14, Ohio

Circle No. 12 on Reader Service Card

book reviews

Continued from page 43

The Extrusion of Metals, *V. V. Zhoiobov and G. I. Zverev; Order 61-21264, Publications and Public Information Dept., Office of Technical Services, U. S. Dept. of Commerce.* 650 *pages.* $8.00

This is a translation of the Russian manual on metal extrusion, considered by most Russian metallurgists as the "bible" in the extrusion field. The manual is intended for use by engineers, technicians, and students. It deals with the theory of extrusion and describes the technology concerning the extrusion of various metals and alloys. Data is presented on the design, fabrication, and operation of extrusion tools and equipment.

A detailed discussion of the characteristics of extruded products cover such items as residual stresses in extruded products and nonuniformity of structure. Microstructures and macrostructures of extruded metals are shown. Theoretical and experimental investigations of metal flow during extrusion are discussed.

The Machining of Steel, *F. C. Lea and E. N. Simons; The MacMillan Co., New York,* 1960. 208 *pages.* $5.00

This is the second edition of a book first published in 1945 covering the fundamental principles of cutting and shaping steel and its alloys. It covers turning, planing, shaping, milling, drilling, broaching, reaming, and sawing. Included is practical information on machines and methods.

This edition has been fully revised and the plan of the book altered. Much material has been added, including information on electro-spark cutting and developments in the techniques of cutting hard metals.

Although the title refers to the machining of steel, the greater part of the information applies to the machining of most ferrous and non-ferrous metals in common use.

"TIFFIN POTS LAST LONGER"

This is a report that we continue to receive from our customers.

Standard melting kettles and machine pots direct from stock are available for all non-ferrous metals.

Special pots are made to your specifications.

We also furnish the following parts in Tiffin alloyd iron or alloyd steel:

- PLUNGERS
- NOZZLES
- GOOSENECK NOSES
- THERMO COUPLES
- INGOT MOLDS
- BAR STOCK

All parts are especially engineered to give the best possible service in the die casting field.

OVER 50 YEARS EXPERIENCE in the manufacture of quality pots and die equipment.

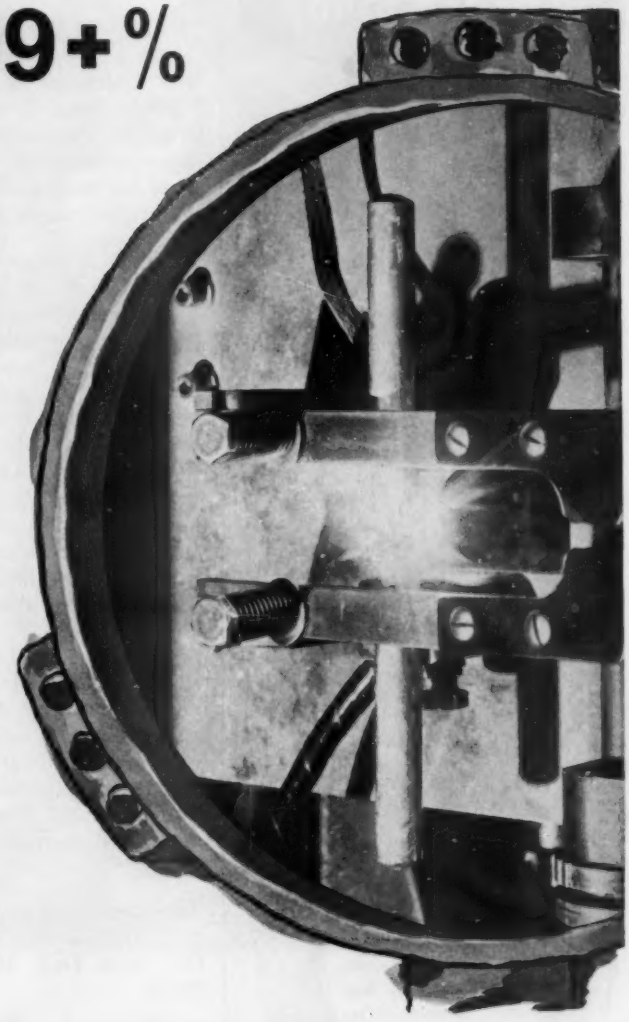
FREE BROCHURE lists stock pots.

Be Thrifty — Be Wise
Use The Best . . .

THE TIFFIN FOUNDRY, INC.
Phone: Gibson 7-3991
TIFFIN, OHIO

Circle No. 68 on Reader Service Card

22,500 VOLT "SEARCHLIGHT" Constantly Watches ST. JOE 99.99+% ZINC QUALITY



A blazing high voltage arc which illumines the composition of metal is part of the modern scientific equipment St. Joe uses to insure unvarying zinc purity.

Samples of every heat of St. Joe zinc are analyzed by the Direct Reading Spectrometer. The samples are placed in the Spectrometer electrode holders and the extremely high voltage creates an arc between them. As elements are vaporized, light from the arc is broken into element lines of varying light energy.

This energy, directed to photomultipliers (photosensitive electronic tubes), is converted to electrical energy which actuates precalibrated dials (see photo) that indicate elements directly IN PERCENTAGES! In five minutes the zinc sample can be completely analyzed for iron, lead, cadmium, copper, aluminum, indium, tin, antimony, silicon and magnesium. Two minutes later, casting room operators know whether or not they are holding critical purity specifications.

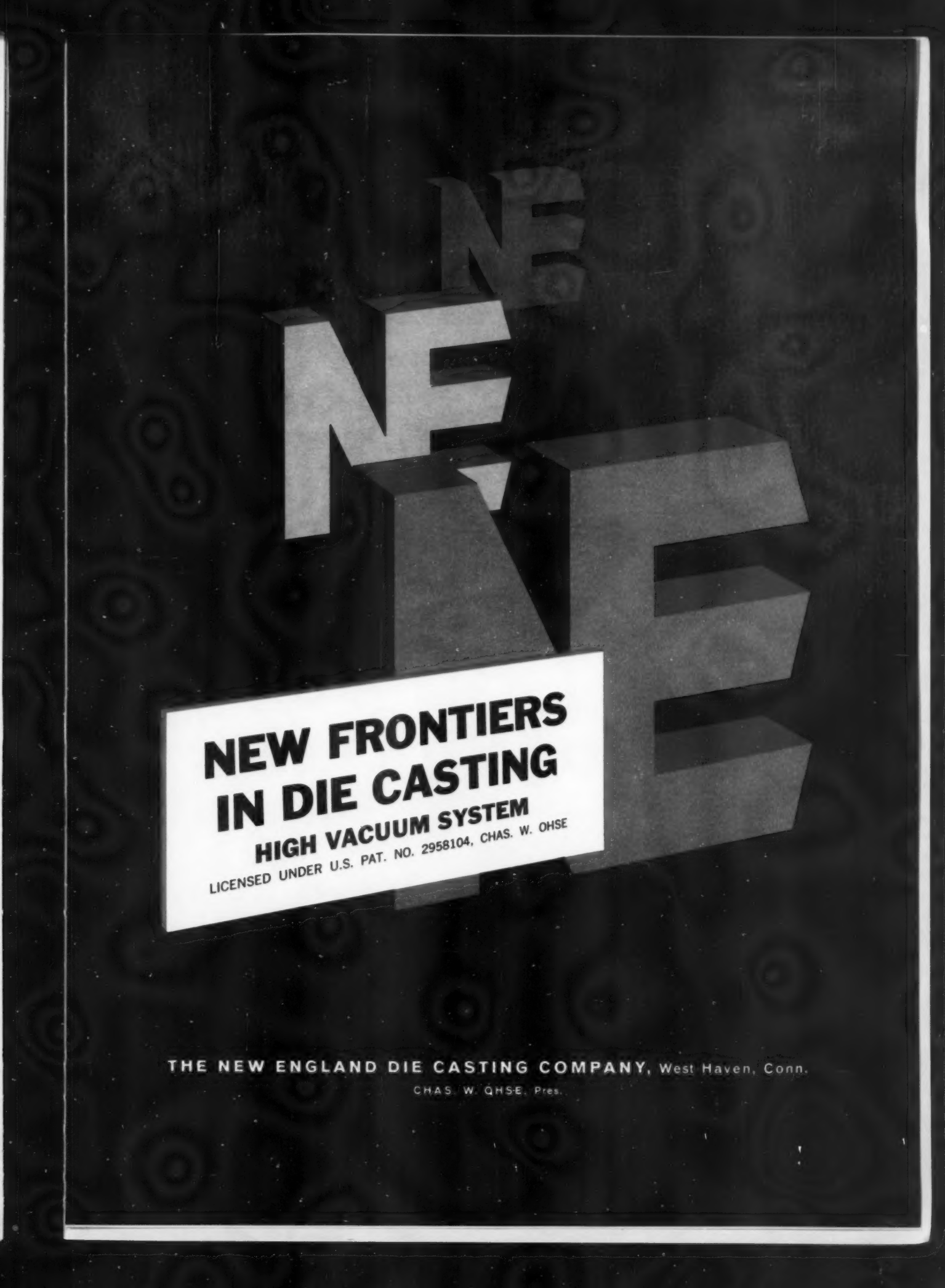
Stringent, continuous quality control backed by St. Joe's reputation as a supplier of quality metal is your assurance of consistent die casting results from St. Joe 99.99+% zinc.

ST. JOSEPH LEAD CO.

250 Park Avenue • New York 17, New York

ST. JOE 99.99+% ZINC

ZN-190


NE
NE
NE
NEW FRONTIERS
IN DIE CASTING
HIGH VACUUM SYSTEM
LICENSED UNDER U.S. PAT. NO. 2958104, CHAS. W. OHSE
THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.
CHAS. W. OHSE, Pres.

NE
30,000 SQUARE FEET
OF MODERN FACILITIES
NEW ENGLAND DIE CASTING COMPANY
445-500 FRONT AVE., WEST HAVEN, CONNECTICUT

Precision
Metal Molding

SEPTEMBER 1961

NOW AND THEN it behooves us to stop and take stock. To look back a bit at where we were and to look ahead to where we are going. In this stock-taking we may not forget to look at our current assets. This is true of people, companies, and industries.

If we have grown, did we grow with our neighbors and our community, or was growth slower or faster?

Maybe in some ways we have grown, while in others we are falling by the wayside. If we are losing ground in some areas, why? What can we do about it?

Most of us, individuals, companies, or industries, are making more money these days, but somehow less of it seems to stick in our pockets. What to do? Sometimes it helps to find out what our neighbors are doing to overcome this.

We are all of us too inclined to put all of the blame on high wages and low productivity. But how much of this is our own fault? As long as we pay the farmers not to raise carrots the price of carrots will be high and we're going to have to pay the inspector who matches colors a high enough wage or salary so that he can buy carrots.

A common prescription for many industrial ills is to get more orders, push through greater production, but not increase the labor force. This works up to a point—the point where the workmen have to run, not walk. They aren't going to run! It's a lot better to put in some machines to run for them.

So in this issue we are giving you the opinions of industry leaders in the PMM industries and some of the statistics of those industries. This is to help you take stock, to find out where you stand in your industrial community and how your planning agrees or fails to agree with your neighbors'.

Now all of this may be interesting, even vital, to the people who make extrusions, castings, and powdered metal parts. It's also both interesting and valuable to the companies who supply those industries. But why should the customers who buy the extrusions, castings, and powdered metal parts care?

Too many times, an engineer has designed for, and a purchasing man bought from, a dying or static industry. Then, a short time later, he can't get parts any more; sources are drying up faster than new ones can be found. Complete redesign becomes necessary; design time, purchasing time, tooling costs, and possible manufacturing facilities have been wasted.

The customers of the PMM industries will do well to study these forecasts and statistics carefully. They'll find that these are growing dynamic industries. Throughout their individual histories they have shown a unique combination of youthful vigor and mature knowledge. There is no substitute for their products or their ability to meet tomorrow's challenges.

P. R. Kalischer

WHAT THE PMM PARTS

Die Castings

DAVID LAINE
Secretary, American Die Casting Institute

DIE CASTING is economically sound. In the next 10 years it will continue its high rate of growth.

Not only will die casting production continue to grow, but in the 1961-1970 decade it is likely to grow *at the same rate* as in the 1951-1960 period.

Zinc die casting production in 1960 was almost 40% higher than the 1951 total and aluminum output was almost 3 times the 1951 figure. This means 1970 totals should amount to 450,000 tons of zinc, and 1,000,000,000 pounds of aluminum.

Not only are such production totals for zinc and aluminum probable, but by 1970 brass die castings should add another 250,000,000 pounds.

No special vision, no magic, and no slight-of-hand figures are needed to arrive at these conclusions. The shape and size of the future can be readily seen from present trends. A reasonable faith in indicated technological advances and a relatively direct projection of statistics make any other conclusion inconceivable.

The first major successful research accomplishment of the Die Casting Research Foundation was the development of a compatible method of improving conventional die casting techniques through a vacuum assist. It is already in use in over 80 custom die casting plants licensed by the Foundation. To this will be added radically new techniques to supplement or replace today's production methods, and new die materials to add life and economies in cost.

These breakthroughs are no longer in the dim future. Successful screen testing has led to the implementation of a soundly based and fully structured program—with many steps already in the development phase.

When, to these technological realities, the full implication of the statistical impact of the already successfully die cast automobile engine block is added, the future of die casting becomes clear.

That the 1970 potential of 450,000 tons of zinc die castings is realistic requires little proof. In 1955, output reached 410,000 tons. With expanding population, high level automotive production and a healthy general economy, a return to the 1955 level is no far-reaching forecast. In fact, in a rising brass die casting market, the high zinc content involved provides an extra factor of safety.

The aluminum die casting 1970 forecast total of 1,000,000,000 pounds is premised on the writer's belief that the automobile engine of the future will inevitably and generally be light metal—from present view, aluminum. This will come before 1970—and die casting will, as certainly, be the production method. The technology has been mastered; its refinement is obvious. Based on 7,000,000 automobiles, the engine application alone will total some 350,000,000 pounds. The remaining two-thirds of the future market will come from related application engineering and normal growth.

To a confirmed pessimist, the obvious reality of the 1970 outlook brings other factors into focus—today's glut of metals will give way to tomorrow's famine and realistic planning for adequacy of supply is a matter for advance programming rather than deficit inducing complacency.

Industry data on page 64

Die Casting for 1962

JOHN L. MACLAREN
President, The Society of Die Casting Engineers

THE AUTOMOBILE INDUSTRY is such a large consumer of die castings that a mediocre model year, or a trend away from massive decorative trim, has a decided effect on tonnages of die casting metals used

PRODUCERS FORECAST

during the year. Introduction of compact models which use fewer and smaller zinc castings for both decorative and functional applications is blamed for the decrease in zinc die cast tonnage in 1960 of some 17% as compared with the year earlier. Growth in aluminum die casting usage due to displacement of other materials in the last two years would have been considerably greater with larger car production.

Zinc tonnage in 1961 will be about the same as the 322,000 tons of 1960, and is expected to increase slightly in 1962 as auto makers make more extensive use of the metal.

Aluminum tonnage will increase at its typical 15% annual growth rate to a predicted figure of 240,000 tons in 1962. The most important factor in this growth has and will continue to be increasing employment of aluminum components by automotive engineers. High-volume production of die cast engine blocks, heads and intake manifolds could double current annual consumption, but will not occur until technical problems are resolved, probably in several years.

The "sleeper" among die cast metals is magnesium which, due to a low base (estimated at 5 to 6,000 tons in 1962), could double or triple virtually overnight if a large user of castings such as an automobile company were to switch over a few parts. Suppliers are promoting their metal carefully yet enthusiastically; interesting results from these programs should be evident in a few years.

All metals will improve their growth positions in 1962 as the result of research and development presently in hand. Progress continues to be made in overcoming corrosion problems encountered in chrome plated zinc castings. Higher purity zinc alloys with superior properties are in the offing, as are more readily welded and anodized aluminum alloys.

The favorable economics of the die casting process in mass production are being increasingly exploited as competition stiffens. In automotive, 1962 will see new die cast transmission cases, instrument consoles, rocker arms, grilles, trim, transaxle cases, mufflers and other major components. The industry will come closer to discovering the secret of casting hollow parts such as manifolds and cylinder heads. There will be progress in developing an adhesive bonding technique for joining die castings together to make complex assemblies.

To achieve these goals die casters will be required to exert a special effort, for suppliers of the iron, plastics, steel and other materials they are attempting to displace are not standing still themselves but are working hard to maintain and increase their positions.

Industry data on page 64

Zinc Die Castings

J. L. KIMBERLEY
Executive Vice President,
American Zinc Institute, Inc.

DIE CASTING as a basic tool for production by American industry has made great progress over the last thirty years. The process has no equal for the manufacture of an endless number of complex and compound shapes and sizes. Although die casting had been known for many years, its growth was at modest rates until 99.99% pure zinc was commercially available and its importance understood. This was substantially accomplished about thirty years ago. Since then the growth of die casting and zinc's use for the purpose have been rapid.

Short time figures on the rate of acceptance of a basic material or the adoption of a process are not enough. Five year averages are believed to bridge the majority of economic cycles and to offer a true picture of actual developments and trends.

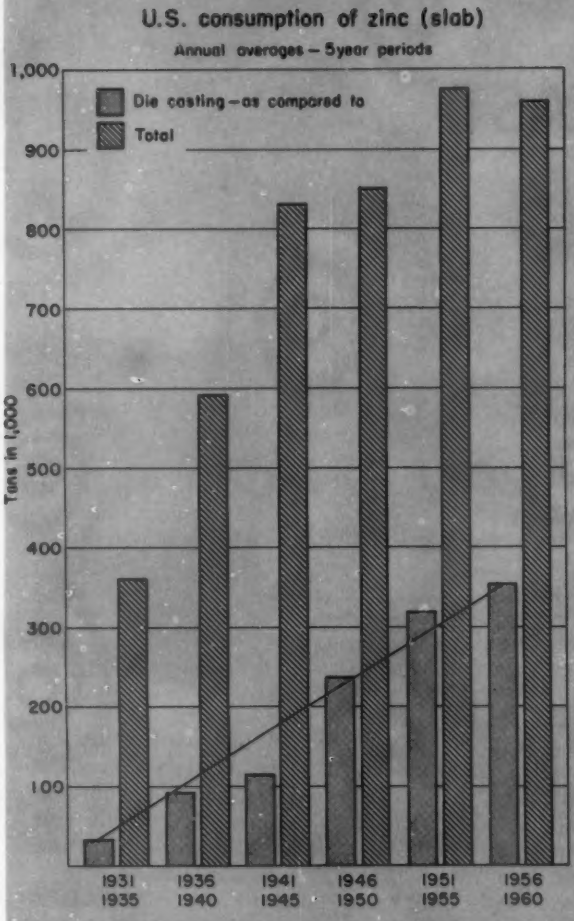
How much zinc is used?

Figure 1 is a plot of domestic consumption of slab zinc both total and for die casting by five year averages since 1931. The steady growth is clear. Only the years 1941-45 and 1951-55 bars depart significantly from uniform growth. The period 1941-45 was certainly depressed by the restrictions of World War II, and 1951-55 strongly influenced by the abnormally high production year 1955. It is tempting, in the face of this evidence of five year averages, to offer a prediction that the years 1961 to 1965 will see an average consumption of zinc for die casting on the order of 415,000 tons per year. This figure comes from an extrapolation of the evidence at hand. What happens in 1962 will depend largely on the industrial state of the nation and the compact cars.

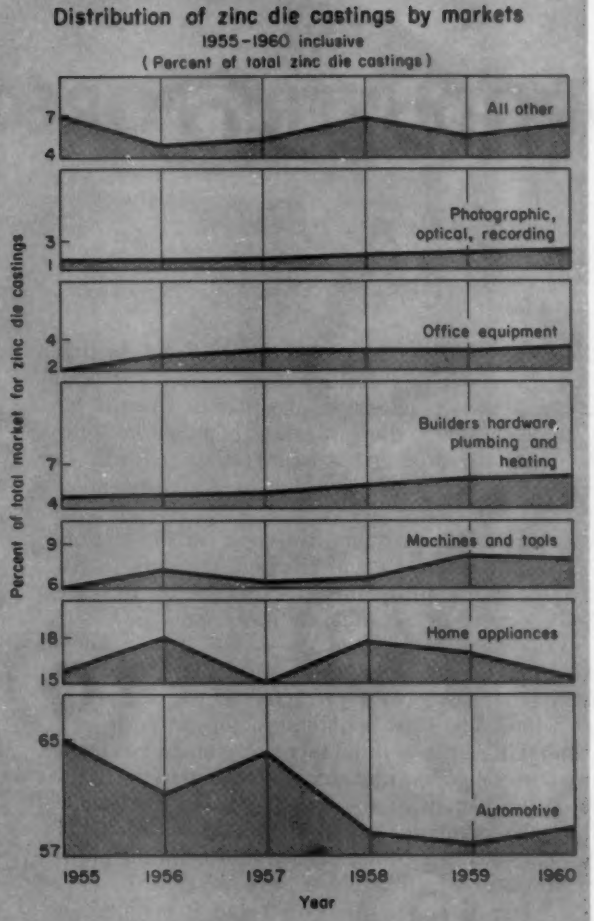
How about competition?

Much has been and is being said about the competition zinc die castings are getting from other materials.

The zinc industry of the United States is well



1. DOMESTIC CONSUMPTION of slab zinc total.



2. PERCENTAGE of zinc die castings in important markets.

aware of the threat posed. Its sales, market development, promotional and research programs are shifting. Instead of a stable commodity, with assured demands approaching capacity, it must move to a position of keen competition.

Progress has been made during the last five years; more must be made. Many of the zinc producers are accelerating their own campaigns, and there has been a tripling of industry expenditure for promotion and research through the American Zinc Institute. Starting in 1958, an Expanded Research Program was activated. There are about thirty active programs, five or six devoted directly or indirectly to zinc die casting.

Zinc's advantages

Every basic material has its peculiar virtues, and the combination of pertinent properties and economics will control usage. Zinc for die casting has general characteristics and specific properties not equalled by other materials. Among the metals which are die cast in volume, zinc has the lowest casting temperature range; its present day alloys have the fastest rates of production and yield the longest die life. Zinc die castings have excellent mechanical properties and long and stable lives; they most faithfully reproduce die shapes and come from the die with the closest casting tolerances. Zinc die castings are made with the thinnest cross sections and are the most readily finished. All these facts commonly result in the lowest cost. It is no accident that zinc die castings are used nearly 2 lbs. to 1 lb. over their nearest competitor, aluminum, and with aluminum's lesser unit weight and common use for larger castings, the ratio by number of castings is undoubtedly even more in zinc's favor.

Plastics are getting a tremendous surge of development and promotion. They are being developed and offered in competition with practically all basic materials from paper, textiles, and other plastics to ceramics and metals. Use will depend on the combination of properties and cost. There will be places where plastic moldings should properly replace zinc die castings, but these will be limited. Remember, metals are electrical conductors; plastics are dielectrics. Metals conduct heat rapidly; plastics slowly. Plastics do not compare well, section for section, in strength, impact resistance, resistance to thermal expansion, malleability, or dimensional control. Commonly, plastics must be thicker. They will not be made with as high rates of production as zinc die castings because of the difference in their ability to dissipate heat. There may be instances where zinc die castings have been over-engineered and offer more strength and stability than the service truly requires. There may be cases where dimensional stability is not important. These are descriptive of the applications where plas-

tics may replace zinc. There will be cases where zinc will replace plastics. It is difficult to cite examples when the competition is so new, and in approaching such a question, the established material is at an obvious disadvantage.

It is important to know where zinc die castings are used. The American Die Casting Institute compiles comprehensive figures to show market distribution of zinc die castings as produced by job shop die casters,[1] but the balance of production (roughly one-third by captive die casters), though known in total from U.S. Bureau of Mines data, is not as well documented by markets. Figure 2 represents the percentage of zinc die castings in important markets starting with 1955. Percentage figures are used since they eliminate the short term and visual fluctuations of the economic cycle. The calculation of the market percentage figures involved the use of the American Die Casting Institute's figures of job shop production adjusted by an educated estimate of the market division among captive casters.

The automotive market

It is obvious that more die castings go to the automotive industry than to any other market. It is notable that the growth in the use of zinc die castings by other industries is lessening the percentage share of the automotive industry. Table I shows the total consumption in tons of zinc for die casting.

Table I—U. S. Consumption Zinc for Die Castings (Tons of 2000 lbs.)

1955	430,807	1958	316,830
1956	360,507	1959	389,331
1957	376,039	1960	321,614 (Prelim.)

Source: U.S. Bureau of Mines

Within the automotive industry—and for short-term future—the great uncertainty revolves around the question of what will happen to the compact cars which now appear to constitute about 35 per cent of the units being made. It is the writer's opinion that the compact cars will become plusher which will mean more zinc die castings. It is probable that the full size cars will continue to become somewhat smaller, and this may mean fewer pounds of zinc die castings because of decreased size.

Much publicity has been given to the improvements in plating systems for zinc die castings over the last three years, and this technical advance has greatly strengthened the position of zinc die castings in the automotive industry. During the past five years, there has not been a year when the average weight of zinc die castings per full size car has not increased. The industry increasingly accepts that luxury and a pleasing appearance mean more zinc die castings. The present average for full size cars is on the order of 75 lbs. per unit as compared to about 30-35 lbs. per compact unit.

The buying habits of the American public may be unpredictable, but it is difficult to visualize long-range austerity in American transportation. We believe that the market loss because of the smaller cars (not only in zinc but in other basic materials) will be reversed.

The American Zinc Institute began a close range field study of die casting three years ago. Of necessity, its effort was concentrated on the automotive market. It now is expanding its capacity to study and serve other basic outlets. Presently, our direct contacts do not justify strong opinions on probable trends in other areas for the use of die castings. Notwithstanding, we are unaware of any reason which would suggest that the growth trends indicated in figure 2 for machines and tools, builders' hardware, office equipment, etc. should be greatly altered. The ups and downs in home appliances are not explained.

Present day zinc alloys offer many advantages for die casting. These include the cost of the metal. But, further improvements must be achieved. The American Zinc Institute's Expanded Research Program has promising programs in research aimed at stronger and more temperature resistant die casting alloys; it is continuing its efforts toward better plating; and is approaching a commercial process equivalent to anodizing. Other programs are in development including a basic study of the flow of molten metals under pressure.

Four hundred thousand tons of zinc per year is a lot of material and constitutes a juicy target for the newcomer. If the zinc and die casting industries do the job in development, sales and promotion that is required, their strong position will be maintained and their growth continued.

[1]See page 85, in this issue.

Industry data on page 64

JERRY SINGLETON
Executive Secretary,
The Magnesium Association

Magnesium Die Castings & Extrusions

THE ULTIMATE STATUS of the magnesium industry seems assured by the fact that it is the one structural metal which need not look abroad for an indefinitely unlimited supply.

Magnesium in all of its forms is still probing markets, seeking out those that promise a real potential for deep penetration in the reasonably near future. Two particular techniques hold much of the hope for a strong future—cold chamber die casting and precision extrusions. In each of these there are technical advantages which in themselves are important and are important plus values to the nominal virtues of magnesium.

At the outset it is well to put magnesium into its proper perspective by the statement of two largely unrecognized facts. Fact one: over one million one hundred thousand *tons* of magnesium have been used in the U.S.A. in the twenty years since 1941. Fact two: at the present time there is more magnesium than any other metal orbiting the earth. These two facts must make it obvious that magnesium is both a fully accepted metal and one which is widely used.

Potential markets

But back to potential markets. The automotive industry is the world's largest user of magnesium. True, the major portion of that usage is in the West German-made Volkswagen, but just as the American automotive industry followed Europe in streamlining, in brake design and in aluminum engines, it is reasonable to assume that sooner or later it will come to recognize that an important reason for the worldwide success of Volkswagen has been its trouble free engine made of magnesium.

Die casting of magnesium parts at 700 shots per hour is something that even Detroit cannot overlook, for it means less manpower, yet gives less weight plus the variation of "fringe benefits" which come with magnesium. A good start in the American automotive market has been made; it is known that 1962 models will present added gains and, gradually, it is expected that the automotive market will become a major one for magnesium.

Extruded magnesium

Extrusions also are a part of this picture. Body builders are finding in magnesium logical answers to the problem of light-weight, sturdy, local delivery bodies. Extrusions plus sheet play an important part in the body shops of International Harvester and the Boyertown Body Works and a lesser but growing role in several other plants.

In material handling, magnesium permanent mold and extruded parts have set a pace that has changed the thinking, not only of the manufacturers of such equipment, but of the users as well. And, the potential market for extruded, forged and cast magnesium in automation programs, while difficult to evaluate, is known to hold important promise.

The development of so-called precision extrusions —extrusions which come from the press to accuracies of ± .002—has already made itself felt in the office equipment industry and has played an important part in winning and holding much electronic, rocket and missile volume.

The combination of extrusions, forging and die castings, all satisfactory up to the 700°-800°F range, has forced both recognition and acceptance in most major space programs. What's more, there are indications that current developments in finishing may widen this market.

Military ground vehicles, radar networks and helicopters are all contributing to accelerate the slow-rising volume of shipments of wrought and precision cast forms of magnesium. However, the timetable of growth is as uncertain as can be. Conversely, the industry feels that it is only the timetable which is uncertain.

Industry data on page 64

Aluminum Extrusions

PAT STOWELL
Reynolds Metals Company

UNQUESTIONABLY there is a future for the aluminum extrusion industry. Whether this future will be one that the industry can look forward to in delightful anticipation, or whether it will be a series of difficult times depends to a great extent upon the people and companies that make up that industry.

By "the industry," we mean all the people and companies engaged in all phases of extruding aluminum. Primarily, it includes those operating extrusion presses, those that supply equipment, raw materials and major supplies to the extrusion press operators, and those manufacturers that buy the products of the industry for further fabrication.

By its very size the industry has serious problems. We have all seen instances where an ill-advised move by an industry member causes a chain reaction. In an over-sensitive industry such as this, often the members fail to correctly focus the results of action by others. Consequently, the effect of the smallest factor may be to precipitate a stampede in the wrong direction.

The problem is simply that basic supply outstrips demand. Then severe competition for the available business passes through the "healthy" phase altogether too quickly, and degenerates to a price-cutting contest. The degradation is faster than the technology of the business can progress to cut costs comparably.

There is an extreme temptation to describe it as "decay" or some equally dramatic adjective rather than "transformation." But there are too many obvious signs of health and too many people, presumably knowledgeable, still getting into it to apply such a term.

It became apparent some time ago that the industry was going to run on a sloppy track in a big field and this brought up the question of how those who were used to competing under much more ideal conditions would fare. This is still being resolved. Some appear to be content to live off past glories and profits and jog along until the old conditions return. Some are running the race with renewed vigor and gusto and have to be classified as good "mudders." Another group seems to be trying to learn to run under the prevailing conditions but just haven't quite got the hang of it yet. There is surely hope and a good future possible for all three groups, but that first group is in for a long wait if they are going to keep up with the pace setters. The best of the better days ahead may not be as good for this industry as some of the past periods of prosperous operations and almost automatic profits.

Diagnosing the problem and its causes in general terms has been relatively easy. The favorite remedy has been put forth by many experts in the past year or two and it sounds good because it is what we all want to hear and believe.

Their remedy is: if metal capacity and extrusion capacity stand still, then demand will surely catch up to supply.

But this is an unlikely set of circumstances and runs contrary to the announced policies of metal fabricators, and producers, both foreign and domestic. New presses and new equipment are being installed every day in old companies as well as new companies in the industry, and there is no reason to believe, and little basis for hope, that this situation will not continue. So therefore it seems that barring drastic and short lived economic upheavals, the industry is faced with a long, long period of excess capacity.

Under such conditions, plant operations and efficiencies must first be evaluated and brought up to date. The press and auxiliary equipment manufacturers are doing their share to this end.

Suppliers are helping the industry

Die steel producers, die shops, billet heater manufacturers, lubrication suppliers, to mention just a few, have made significant contributions to cost-reductions and increased production rates to help their customers keep up with the times. Billet suppliers have allotted extensive time, money and talent to improve their product and suit every whim and desire of their customers. It is an accepted fact that a billet classified as "good" two or three years ago would not stand a chance in comparison to today's billets.

The industry has a wealth of talent and experience. The increased emphasis on plant operations in the recent past has been noticeable and is one of the most gratifying signs of health and awareness of the true problem. Efforts in this direction cannot be relaxed. They must be increased, not only for a single operator to stay competitive in the extrusion business, but for the entire industry to keep up with the rest of the industrial community and with competitive products and materials.

Let us consider sales and sales development. In existing markets for volume extrusions, such as windows, doors, screens, etc., price competition will be a major factor for a long time to come. While competition is always healthy, price cutting not related to increased production efficiency is unhealthy. This is exactly what has happened in this industry. We've let the volume buyers know in the clearest possible terms that "we can be had"—and they have had us, but good.

We just accept the unhealthy condition of extrusions in their major markets. It has been with us so long and is such an obvious problem to even the casual observer that anyone with a workable answer would have been heard from long ago. To correct this condition so that healthy competition may be restored, we must continue to supply quality extrusions so that the vast sums of money, time and effort already spent to attain widespread consumer acceptance of our products will not be counteracted by inferior products.

Large potential market exists

Volumes have been written and many inspirational addresses given on future potentials of aluminum extrusions and the usual reaction of many people in our industry has been, "Sounds great! Where do I go to pick up the order?" The answer, of course, is that you don't; you go someplace and create the order. This can be done, and is being done every day, by applying the limitless engineering, design, technical and promotional talents already at work in our business to the main job that must be accomplished. There is too little evidence of this approach today. Yet most manufacturers of extrusions have men that have already demonstrated in many ways that they have the ability, imagination and technical qualifications to find and develop more customers for different applications of our product. Too few are at work on it when the numbers are compared to the magnitude of the possibilities that are available to be investigated. We've come a long way from the class of suppliers to the aircraft and building markets, but we've got a lot farther to go.

For example, the aluminum automobile engine block has not progressed as fast as was expected and may have reached a temporary plateau, if indeed it is not in danger of slipping backwards. One of the major problems might be solved with an extruded cylinder liner. Some day no liners will be needed, but until the ultimate process can be developed there may be a big opportunity for some ingenious and inventive extruder. There would be a lot more aluminum in the blocks that would be of no interest to extruders, but there would also be a lot of liners per year for the next several years if the alloy, technique of manufacture and the rest of the many difficulties can be worked out.

As soon as a little more work can be done and proven, adhesives may do away with the necessity

for soldering or brazing tubing in heat exchangers, condensers, and evaporators. Then a lot more aluminum tubing will be sold in the appliance field.

In addition to cost advantages over the present materials, the great reduction in weight will be an attractive plus in portable appliances such as mobile room air conditioners, de-humidifiers and automobile air conditioners.

Highway bridge uses extrusions

There is an aluminum bridge being built near Petersburg, Virginia that has been referred to as "the first sheet aluminum bridge." However, extrusions account for 65 per cent of the weight of its aluminum construction. It is a 97-foot span and it contains 48,000 pounds of aluminum. It was bid at about 7 per cent less than the lowest bid for construction and erection of a steel bridge on the same site. Two other aluminum bridges are under construction and the idea is sure to catch on once these practical demonstrations are more widely appreciated.

Aluminum towers for electrical transmission lines are a fact today but are really in their infancy. If the projected power requirements of this country for the immediate future materialize, this infant is due for a very robust childhood. And it's extrusions all the way.

At least one manufacturer is now machining cages for roller bearings from aluminum tubing. It has been said that the world moves on bearings and it is only a slight exaggeration. The potential for tubing in this application can hardly be exaggerated.

The impact extrusion process is rapidly developing and will be engineered into many new applications and markets in the immediate future. Existing extrusion facilities can be utilized to make raw materials in rod or slug form for this new and growing industry.

Electrical equipment manufacturers as a group are a prime target for new extrusion applications.

Material handling market

Containerization is on the verge of a major revolution in the transportation business and will be a factor in the movement of many types of goods and commodities. Aluminum extrusions fit very nicely into the development of this program—but again we know of very few purchasing agents looking for an extruder to take an order. The groundwork is yet to be completed.

From a vantage point on the sidelines, neither too close nor too far from the action, it appears that the future of aluminum extrusions will be determined by the ingenuity, operating proficiency, ethics and business judgment of the participants far more than it will be determined by any "soaring sixties" or other pie-in-the-sky forecasts that predict everything will work out on a business cycle or population explosion basis with nothing required on our parts but patience.

Industry data on page 74

JOHN H. MORRISON
President, Investment Casting Institute

Investment Casting

THE INVESTMENT CASTING INDUSTRY will show a 10% gain in 1961 over 1960.

Total sales for the industry were approximately $87,000,000 in 1960, divided into two basic segments —military and industrial (figure 1). The military segment manufactures a substantial volume of aircraft jet engine blades and vanes. This portion of the industry, after a continuous rise throughout World War II and the Korean War, started to decline in 1957 as manned aircraft production was cut back. During the last few years, however, the industrial segment has been steadily growing as more and more manufacturers are beginning to recognize the advantages of investment casting for component parts. Some examples of these new sources of business are gas turbine structurals, aircraft structurals, components for such items as pumps, instruments, valves, motors, special tools, appliances, etc.

An indication of this increased recognition of the investment casting process in the metalforming industry is the trend of net sales of industrial investment

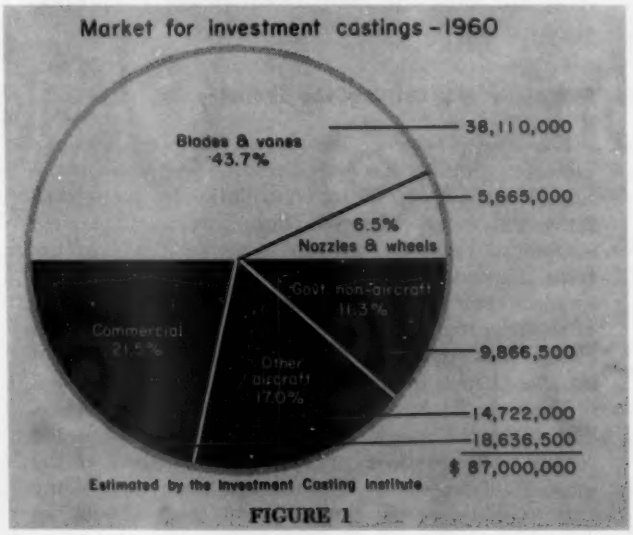


FIGURE 1

castings. Using 1955 as a base of ten, net sales have gone to 186 in 1960. In the recession year of 1958 there was only a slight dip in demand, and increased use of industrial investment castings was evident in 1959 when this segment of the industry made a 30% increase over 1958. For 1960 the increase was about 10% (figure 2).

The I.C.I. is optimistic over the long-range growth of the industry as more companies become aware of the technical advances which have been made, as well as the cost advantages possible. In addition, the long-range trend in the demand for more complex components, and the increased use of the higher alloys, will mean more volume because many such parts can only be made by the investment casting process. Another factor which should contribute toward the industry's growth is the continued increase in the cost of all machining operations—machine tools, metals, and labor. Thus investment casting can offer unique advantages—saving of capital expenditures and operating costs. This will certainly be more important to metalworking manufacturers in the years ahead.

It is now evident that in 1956-1957, the industry added production capacity at a rate sufficient to double casting production. In 1960, for example, when the sales of the industry were about $87,000,000 it was estimated that the productive capacity of the industry was about $200,000,000. The result has been a profitless prosperity for many investment casting producers, and the last few years have seen several mergers, consolidations, and dissolutions of investment casting companies.

Various reports indicate a tremendous growth of the investment casting process in Russia, and an extremely vigorous investment casting industry, concerned primarily with industrial parts, in England, France, Germany, Italy, and Switzerland. In England and Europe there is a very definite trend in the use of close tolerance, highly finished investment castings to eliminate costly machines, machining, and chip cost. For example, it is reported that the Pfaff Sewing Machine Co. has eliminated many of their machine tools and now produce over a million parts per month by investment casting, using investment casting dies for something over 1400 different parts. Some U.S. companies are beginning to follow this idea, and are embarking on value analysis projects to determine whether it is more efficient to buy some components from "specialists" rather than make them.

In this area of industrial castings there appears to be a trend toward castings of aluminum and copper for more inexpensive industrial applications. In response to an increased demand for high temperature materials and super steels, many of the larger investment casting companies have installed vacuum casting equipment. It is felt that the market for castings made of vacuum-melted and cast-metal will increase in such applications as gas turbines and space vehicles.

Industry directories indicate that there are over 100 firms in the investment casting business ranging in size from five employees to approximately 1600 employees. It is estimated that less than ten of these companies do $2,000,000 a year or more in sales.

Industry data on page 71

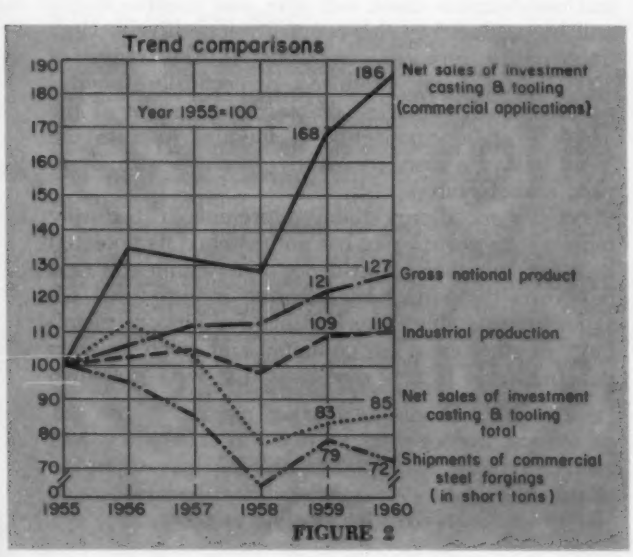


FIGURE 2

Powder Metallurgy

KEMPTON H. ROLL
Executive Secretary, Metal Powder Industries Federation

POWDER METALLURGY PARTS, i.e., gears, cams and other structural and mechanical components as well as self-lubricating bearings, represent a comparatively mature industry. Their growth pattern represents a steady upward picture.

Trend toward bigger parts

Trends in powder metallurgy parts are fairly conspicuous. According to the Powder Metallurgy Equipment Association, larger presses are being ordered and more parts manufacturers than ever before are equipped with higher tonnage presses pointing the trend toward larger parts—in the order of one to two pounds each. Powders are being improved to the point where large parts can be made within the capabilities of existing equipment. Better mechanical properties are possible without secondary operations.

Substantial improvements have been made in the fabricating properties of stainless steel powders in the last year, i.e., higher green strength, better compactibility and, more important, the ability to sinter stainless steel parts in conventional powder metallurgy processing equipment. Previously, special equipment had been required. Now any established parts manufacturer with the capability of sintering iron-carbon or iron-copper-carbon powder compositions has within his grasp the ability to manufacture highly satisfactory parts from a number of standard AISI alloys including 304, 314, 347, and 410.

The automotive industry still represents the largest market for powder metallurgy parts and, according to a forecast by the Chief Engineer of the Amplex Division of the Chrysler Corporation, by 1965 the number of pounds of powder metallurgy parts per automobile will double today's figure. Other authorities forecast four times this amount.

Other growth areas are obvious: home appliances, business machines, and wherever mass-produced mechanical components involving high labor costs are required.

Other applications

The horizons for powder metallurgy as a means of manufacturing exotic materials, creating unique alloys, and combining normally immiscible materials, are unlimited. Long the work-horse technique for producing tungsten, molybdenum, and cemented carbides, powder metallurgy is in the forefront as the only practical means of converting some of the newer superalloys and refractory materials into useful form. There is a trend toward greater application of such materials as niobium, beryllium, titanium, and zirconium.

Large porous structures

Powder metallurgy's unique ability to create large, porous metallic structures will find greater application in the manufacture of molds for ceramic molding —some weighing as much as 300 pounds apiece. Blow molds for plastic bottles are now being made from porous metal on an experimental basis.

Copper mill products

Copper sheet and tubing made from powder has been heralded for some time—almost to the point where it was regarded as one of the false hopes of the industry. However, in my opinion, it is not unrealistic to predict the commercial manufacture of copper tubing made from copper powder within the next year or so. Relatively large tonnages of copper powder are being used even now in the manufacture of thin-walled copper tubing for refrigerator coils. It may take longer for economic commercial manufacture of copper sheet from powder to materialize in this country, but I believe it purely a matter of time. That this is likely to take place is supported by the plans of Marinduque Iron Mines Agents, Inc., of Manila. This company will build a fully integrated copper extracting and fabricating plant on the island of Mindanao in the Philippines. A development of particular significance to powder metallurgy, it marks the first large-scale application of powder metallurgy to the manufacture of finished shapes from powder produced directly from ore. Low-grade copper ores will be turned directly into high-quality copper powder which will then be converted into strip, tubing, and wire at the same installation and without involving any melting operations.

Metallic friction materials

Metallic friction materials have also been on the scene for many years. Besides clutch facings used in automatic transmissions and other heavy duty applications, sintered metal brake linings produced by the Delco Moraine Division of GMC have been manufactured as a service item for Chevrolet passenger cars since 1957 and have proven to be exceptionally effective. Delco Moraine points out that the greatest advantage powder metallurgy has to offer here is complete elimination of brake fading, i.e., failure to maintain coefficient of friction at elevated temperatures. For the same reason, but on a larger scale, the Raybestos Division of Raybestos-Manhattan has for the past year been supplying sintered metal brake blocks for use in heavy duty logging trucks.

Batteries

Batteries employing powder metallurgy products will find more widespread use. The high porosity sintered structure possible only through powder metallurgy makes for a highly efficient battery plate structure resulting in the more widespread use of nickel-cadmium and silver-zinc batteries.

Refractory metals

For many years, tungsten and molybdenum have been produced in Europe by powder metallurgy techniques and usually at lower costs than domestic manufacturers. With aroused interest in these metals, we should find greater activity on the part of domestic manufacturers in this area to the point where tungsten and molybdenum sheet, rod, wire, and massive shapes will be produced in this country competitively. High temperature furnaces, operating in the range of 3200°F, are being produced domestically for this purpose. Such furnaces combined with some of the newer isostatic compacting techniques indicate the trend toward a more competitive position with European manufacturers.

Powder metallurgy today represents a maturing industry. Its growth rate has not matched its potential thus far, but there is evidence that within the next few years the parts manufacturing industry will advance considerably. The horizons for powder metallurgy in other areas are unlimited and much progress is being made in new directions that were unknown a year or so ago.

Industry data on page 72

GEORGE W. SWENTOR
Sales Manager, Ansonia Div., Anaconda American Brass Co.

Extrusion of copper and copper base alloy

THE DEVELOPMENT of the art of hot extrusion reaches well back into the last century. Starting with the shaping of solid rods, the process and techniques have improved significantly over the years to the point where present capabilities for the production of intricate cross-sections have much to offer the value- and cost-conscious designer.

Copper and copper-base alloy extrusions fall into two general categories—(1) Industrial, for mechanical applications, and (2) Architectural, for ornamental embellishment—although in the former instance both purposes are well served. Here we shall deal only with Industrial.

Pure copper and the leaded brass alloys are the most commonly used material in this classification—Copper, mainly for its excellent electrical conductivity, and the leaded brasses for ease of machining. Many other copper-base alloys, with more favorable physical properties for specific applications, containing one or more of the elements aluminum, silicon, nickel, chromium, tellurium, zirconium and others, also have hot extrusion possibilities within certain prescribed areas of size and design.

In many instances the dimensional accuracy of shapes in the "as extruded" condition, is well within the normal requirement, but where closer tolerances are needed they can be obtained by subsequent cold drawing. This operation also imparts a harder surface and improved physical properties when these are deemed important.

Copper, in any event, is generally cold drawn after extrusion. Since it flows more sluggishly than the leaded brasses, slight irregularities which may occur in extrusion are thus "ironed" out and closer dimensional accuracy, usually required, is achieved.

The smooth surface of extruded shapes reduces or eliminates many finishing operations, and "pre-shaping" in this manner has a significant effect upon scrap loss. Long bars of constant cross-section are readily sliced to required lengths. The principal limitation to be observed is that grooves, slots, etc., must parallel the axis of the extruded bar.

The end uses are infinite—wherever a shaped bar is required, within a size range of ⅛" to 6" in corner to corner measurement, it or a close approximation can usually be produced by extrusion and the cost savings can be substantial.

Extrusions of copper and its alloys have made important contributions to many mechanical applications:

Pure copper in various shape configurations for the electrical industry—circuit breakers, switches and relays, generators, control systems, bus conductors, etc. —wherever high electrical conductivity is an important requisite.

Copper alloys for builders' hardware, camera, dental and surveyors' equipment, parking meters, locks, garden tools, meter parts, paper making machinery, plumbing goods, welding equipment, and a host of others.

The inherently favorable characteristics of copper and its alloys, coupled with the capabilities of extrusion, should not be overlooked in serious studies of cost and value analysis.

Industry data on page 74

Uncommon extrusions*

THERE IS NOTHING very foreign or strange about zirconium, titanium, niobium and tantalum, molybdenum, tungsten, or special-property steels. These metals are not "exotic", only uncommon. More accurately, they are "newer metals" now being fabricated commercially in substantial quantities.

Extruded reactor-grade zirconium tubing is a standard item for atomic energy installations, which will be promoted in an ever-expanding nuclear industry market.

Where thermal neutron absorption is not important but high strength, lightness, corrosion-resistance and long life are important, extruded titanium is now used. "For the chemical process industries," says Homer M. Harvey, vice president of Harvey Aluminum, "titanium is unsurpassed among the structural metals. It is twice as strong as aluminum and is superior or comparable to all but the highest strength steels.

"Industrial heat exchangers, as a case in point, provide excellent examples of suitable applications for all kinds of titanium tubing. In an environment of brackish water or sea water, whether heat is exchanged or not, titanium's corrosion-fatigue strength is far beyond that of any other structural metal. Pickle packers in the food processing industry have

**This forecast was prepared by the technical staff of Harvey Aluminum, Inc., Torrance, Calif.*

taken advantage of this characteristic of titanium tubing for many uses besides heat-exchanging because the metal is impervious to brine which usually causes pitting. Equally important to them is the fact that foods never have a metal taste after being processed in titanium equipment. Their industry is not alone, however, in discovering the advantages of titanium — the list of users will grow rapidly as continuous price reductions expand the metal's field of applications."

Cost reduction through volume production is an avowed goal in dealing with the newer metals. Included, too, are the refractories: molybdenum, niobium, tantalum, and tungsten. Extrusions made of these metals are currently and literally out of this world since applications are almost wholly confined to rocket-nozzle entrance, throat and exit areas. But niobium is great for liquid metal loops in power reactors, as if that brought the subject back to earth.

In a sense it does, because Harvey Aluminum is convinced that the high-speed, high-heat, high-stress demands of today's advanced technologies will become tomorrow's industrial requirements for which various refractory-metal alloys are being developed. Meanwhile, commercial needs in these rather rare categories are fairly well filled with one or another of the special-property steels. For example, the custom configurations of PH 15-7 Mo extruded for the B-70 prototype could be adapted to turbine blade shapes in jet-electric power generators of public utility plants.

Whatever the ultimate range of application may be for extrusions of uncommon metals, one thing is sure: they will have to be hard, tough, and resistant to more and more exacting environments.

OUTLOOK FOR REACTIVE, REFRACTORY & RESISTANT METAL EXTRUSIONS

Alloyed Material	Possible Uses	Possible Users
Zirconium	Reactor grade quality for nuclear fuel elements, heat exchangers, shielding, structural parts, and process tubing. Commercial grades for handling corrosive and radioactive materials.	Nuclear and chemical processing industries
Titanium	For chemical, marine, food processing, power units, transportation - including aerospace - petroleum and electronic installations, facilities and equipment.	Military and commercial industries of all kinds
Niobium (or columbium)	Liquid metal containment	Atomic power industries
Tungsten Molybdenum Tantalum	High-heat, high-stress applications exemplified by rocket and spacecraft requirements.	Military and commercial advanced-art technological industries
Special-property Steels	Intermediary elevated temperature applications for environments similar to those encountered in present-day high speed aircraft structural and skin uses.	Industries requiring unusually resistant materials

THE UNITED

Over a billion dollars in sales and three quarters of a billion dollars in wages and purchases, certainly are not small potatoes. But that's a conservative estimate for the die casting industry in this country.

Over 1400 plants are spread through 41 of the 50 states and employ over 100,000 people directly in the production of die castings. Of the total number of shops, 60.8% are jobbing die casters and the balance so-called captive shops. In this latter group, almost one-fourth will do jobbing work, only if internal work does not keep the shop running at capacity.

How do we know these facts and what else is known about the industry? To get the facts, PRECISION METAL MOLDING *surveyed 1175 of the known 1420 establishments which make die castings. Of the 1175, 705 are jobbers and 470 captive or captive/contract. Not all of the companies who responded answered all of the questions we asked, nor were all of the replies usable. However, in projecting any figures from the survey to the entire industry no sample less than 10% of the total was used and in most cases the sample was over 30%. The over-all return from 1175 plants was 34.8%.*

Projections for the industry were made by getting a simple arithmetical average per plant from the usable replies and multiplying by the known number of plants. In many cases we were able to check our projections with figures from other sources such as the American Die Casting Institute, the Bureau of The Census, the Department of Labor, and others. In all cases a difference of less than 10% was found.

Let's see, then, how big the industry is, what it buys per year, and what the expansion plans of the industry are. Where a distinction is made between jobbing and captive shops, all those shops who list themselves as both jobbing and captive are included in the captive category.

STATES DIE CASTING INDUSTRY

How big is the die casting industry?

Where are the shops?

There are 1420 known die casting establishments with this geographical distribution:

Alabama	5	Missouri	35
Arkansas	15	Nebraska	10
California	210	N. Hampshire	2
Colorado	20	N. Jersey	78
Connecticut	36	New York	153
Florida	11	No. Carolina	12
Georgia	11	Ohio	118
Idaho	1	Oklahoma	4
Illinois	181	Oregon	15
Indiana	46	Pennsylvania	76
Iowa	23	Rhode Island	11
Kansas	5	So. Carolina	1
Kentucky	8	So. Dakota	1
Delaware	1	Tennessee	13
Louisiana	2	Texas	25
Maine	2	Utah	1
Maryland	7	Vermont	1
Massachusetts	33	Virginia	5
Michigan	168	Washington	15
Minnesota	17	Wisconsin	37
Mississippi	2		

How many people are employed?

The total employment in the jobbing shops in these states is 71,699 and of these 56,330 are production employees. If we assume that employment in captive shops is about the same as in jobbing shops we can estimate production employees for the captive shops as 37,550 or a total, without non-production workers, of 93,880.

The U.S. Department of Labor, Bureau of Labor Statistics gives average employment in the primary metal industries for 1960 as 1,185,700. The die casting industry, therefore, accounts for about 7.9% of the total employment in this industrial group.

How much metal is cast?

The U.S. Department of Commerce, Bureau of The Census provides accurate figures on the weight of metal die cast in both jobbing and captive shops. Their figures show that in 1960 the industry cast:

48.2% of all aluminum cast or 361,600,000 lbs.
1.7% of all copper base cast, or 13,400,000 lbs.
32.3% of all magnesium cast, or 7,600,000 lbs.
98.6% of all zinc cast, or 614,500,000 lbs.
Total of all metals cast 997,100,000 lbs.

How many machines are installed?

In the 1175 shops studied there are 10,140 die casting machines installed. These are divided between:

jobbing shops with 6982 machines;
captive shops with 3158 machines.

This gives an average, per shop, of 8.63 die casting machines. The size breakdown in terms of tons locking force is given in Table I, and the age of the machines is given in Table II.

The use of reduced air pressure in the die cavity is a growing tool of the industry and this year we find that a significant percentage of the installed machines are vacuum-equipped. The percentage of

TABLE I—SIZE OF INSTALLED DIE CASTING MACHINES[1]

Locking force in tons	Jobbing Shops H	Jobbing Shops C	Jobbing Shops T	Captive Shops H	Captive Shops C	Captive Shops T	Total (Jobbing & Captive) H	Total (Jobbing & Captive) C	Total (Jobbing & Captive) T
Under 100	29.52	2.56	17.76	33.72	9.92	20.16	30.29	4.68	18.32
100-250	22.57	11.13	17.60	22.10	7.38	13.67	22.48	10.04	16.76
251-400	25.82	29.51	27.43	23.24	29.54	26.74	25.32	29.52	27.30
401-500	9.90	17.79	13.33	8.51	14.55	11.97	9.63	16.86	13.02
501-750	9.31	28.56	17.70	9.03	25.53	18.53	9.27	27.70	17.89
751-1000	2.57	6.59	4.32	2.55	12.87	8.45	2.57	8.40	5.29
1001-1500	0.06	2.48	1.12	0.85	0.00	0.36	0.22	1.77	0.83
1501-2000	0.25	1.38	0.74	0.00	0.21	0.12	0.22	1.03	0.59

[1] Figures are percent of total machines.

TABLE II—AGE OF THE MACHINES[1]

Age in years	Jobbing Shops			Captive Shops			Total (Jobbing & Captive)		
	Hot Chamber	Cold Chamber	Total	Hot Chamber	Cold Chamber	Total	Hot Chamber	Cold Chamber	Total
Under 5	32.30	29.50	31.09	29.73	48.45	40.72	31.81	35.20	33.35
5-10	35.02	45.30	39.51	28.52	31.51	30.28	33.80	41.81	37.30
11-15	24.15	19.70	22.16	24.02	13.54	18.48	24.11	18.18	21.32
16-20	5.30	4.46	4.93	13.22	4.23	7.92	6.76	4.38	5.65
Over 20	3.23	1.04	2.31	4.51	1.27	2.60	3.52	1.13	2.38

[1] Figures are percent of total number of machines in each age group.

installed machines so equipped is:

Jobbing shops	8.54%
Captive shops	4.35%
Total shops	7.55%

In number of machines this means that the jobbing industry has almost five times as many vacuum-equipped machines installed as does the captive segment of the industry. The wide diversity in the types of work done by the two segments of the industry easily explains this difference.

What are the sales of the jobbing segment?

Figures for gross sales were supplied by a significant number of jobbing die casters. These figures include the value of all machining and surface finishing done on the castings by the die caster as well as the value of tooling. Table III gives the figures found by the survey.

TABLE III
GROSS SALES OF JOBBING SHOPS

	Total of shops responding	Average per shop reporting
1955	$ 86,879,649	$1,034,281
1956	91,104,996	1,035,284
1957	111,235,781	1,112,358
1958	103,635,100	959,575
1959	129,513,521	1,126,204

Based on the 1959 reported sales the indicated value of shipments from jobbing die casters is shown in Table IV.

TABLE IV
GROSS SALES OF THE JOBBING DIE CASTERS

Sales for all shops	$793,971,000
Sales per employee	13,279
Sales per production employee	16,541
Sales per installed casting machine	131,098

(Note: The American Die Casting Institute gives sales for the jobbing industry in 1959 as $395,050,000. To this must be added $240,000,000 for finishing operations. The National Tool and Die Manufacturers Association estimates the total value of tooling to be in excess of $100,000,000. This gives a total of more than $735,050,000.)

How many trim presses are installed

Roughly, there is one trim press installed for each casting machine. Mechanical presses are far more widely used than hydraulic presses, but as we shall see later there appears to be a trend toward hydraulic presses as new equipment is installed. Present installations of trim presses are given in Table V.

TABLE V
NUMBER OF TRIM PRESSES NOW INSTALLED

	Jobbing Shops	Captive Shops	Total
Mechanical	4870	2982	7852
Hydraulic	2013	496	2509
Total	6883	3478	10361

How many plants use fire resistant fluid?

No figures for the use of fire resistant fluid can be projected for the entire die casting industry. While a significant number of companies reported on this question they were, among the jobbers, mostly the large companies, so that a projection would be meaningless.

Of the companies reporting, we found that:

	Percent who use F.R.F.	Gal. per plant per year
Jobbers	62.4	3130
Captive	72.8	2888
All shops	65.5	3050

How many, & what kind of furnaces are installed?

Electrically heated and gas or oil (fuel) heated breakdown furnaces and holding pots are used by the

TABLE VI
DISTRIBUTION OF FURNACES IN THE DIE CASTING INDUSTRY

	BREAKDOWN FURNACES			HOLDING POTS		
	Fuel Heated	Electric Heated	Total	Fuel Heated	Electric Heated	Total
Jobbers	2185	169	2254	4840	691	5531
Captive	1056	366	1422	1033	2068	3101

TABLE VII

	Make all dies inplant	Make some dies inplant	Make no dies inplant
Jobbers	21.5%	48.3%	30.2%
Captive	25.8	33.9	40.3
Total Industry	22.0	45.7	32.3

die casting industry. Of these, fuel fired units are used about 3 to 1 over electrically heated ones. Table VI shows the distribution of these furnaces.

Where does the industry get its dies?

Most die casters get all or part of their dies made by outside tool and die shops. While every die caster operates a tool room, many use it for repair and maintenance only and a few make some of the smaller, simpler dies. Table VII gives the percentage breakdown between outside and inplant die shops.

How many use die heaters?

Almost one-half of the die casting shops use die heaters of one type or another. The survey showed that 44.3% of the jobbers and 43.5% of the captives use these heaters. For the entire industry, 44.1% of the companies use these units.

What does the die casting industry buy?

Production workers wages

The U.S. Department of Labor, Bureau of Labor Statistics gives the average weekly wage for production workers in non-ferrous foundries as $101.30.

The jobbing die casting industry employs 56,330 production workers to give an annual pay roll of $296,658,440. Based on our previous estimate of the number of production workers in the captive plants, the total wages for production workers in the die casting industry is $575,480,032.

Purchases of die casting machines

The useful life of a die casting machine, if given reasonable care, is certainly more than 20 years. We have seen that only 2.38% of the installed machines are more than 20 years old or approximately 250 die casting machines.

Statistics collected since 1952 indicate a steady sale of new die casting machines. While sales vary with general business conditions there is every indication of steady growth of the industry. Table I gives

TABLE I—TOTAL MACHINE SALES

(Domestic and foreign, hot and cold chamber)

Locking Pressure Tons	1952	1953	1954	1955	1956	1957	1958	1959	1960	1st half 1961	1st half comparison 1960	1st half comparison 1961
Under 100	56	65	133	168	206	201	188	141	145	43	78	43
101-250	28	32	57	67	50	28	25	51	52	32	32	32
251-400	43	70	51	86	55	53	29	86	70	27	46	27
401-500	36	49	82	78	37	51	24	24	28	11	21	11
501-750	26	50	80	109	85	71	18	31	56	25	46	25
751-1000	9	20	0	33	33	35	36	48	35	26	19	26
1001-2000	0	0	0	0	0	0	1	2	4	8	3	8
TOTAL	198*	286*	403	541	466	439	331	383	390	172	245	172

* Domestic Sales Only; Foreign Sales Not Available

DOMESTIC MACHINE SALES

HOT CHAMBER

Locking Pressure Tons	1952	1953	1954	1955	1956	1957	1958	1959	1960	1st half 1961
Under 100	52	64	73	83	111	129	138	109	117	40
101-250	16	16	15	39	32	8	15	35	33	18
251-400	5	27	8	32	23	17	19	44	33	12
401-500	19	22	41	49	22	27	12	12	17	7
501-750	5	20	20	43	12	3	6	11	17	5
751-1000	4	4	0	10	20	1	3	17	7	10
1001-2000	0	0	0	0	0	0	0	0	0	2
TOTAL	101	153	157	256	220	185	193	228	224	94

COLD CHAMBER

Under 100	4	1	4	8	14	13	12	5	6	0
101-250	12	16	19	13	14	9	6	10	8	13
251-400	38	43	28	39	28	30	9	33	22	9
401-500	17	27	37	29	12	24	22	12	8	4
501-750	21	30	57	62	73	66	11	20	35	19
751-1000	5	16	0	22	11	33	29	29	23	15
1001-2000	0	0	0	0	0	0	1	2	4	4
TOTAL	97	133	145	173	152	175	90	111	106	64
All Domestic Sales	198	286	302	429	372	360	283	339	330	158

FOREIGN MACHINE SALES

HOT CHAMBER

Locking Pressure Tons	1952	1953	1954	1955	1956	1957	1958	1959	1960	1st half 1961
Under 100			45	65	73	52	33	24	21	2
101-250			12	5	0	3	2	3	6	0
251-400			5	0	3	5	1	6	3	4
401-500			2	0	2	0	0	0	0	0
501-750			0	0	0	0	0	0	2	0
751-1000			0	0	0	0	1	1	0	0
TOTAL			64	70	78	60	37	34	32	6

COLD CHAMBER

Under 100			11	12	8	7	5	3	1	1
101-250			11	10	4	8	22	3	5	1
251-400			10	15	1	1	0	3	12	2
401-500			2	0	1	0	0	0	3	0
501-750			3	4	0	2	1	0	2	1
751-1000			0	1	2	1	3	0	5	1
1001-2000			0	0	0	0	0	0	0	2
TOTAL			37	42	16	19	11	9	28	8
All Foreign Sales			101	112	94	79	48	43	60	14

TABLE II

VALUE OF DIE CASTING MACHINES BOUGHT IN 1960

Size of machines (tons)	No. Machines Hot Chamber	No. Machines Cold Chamber	Approximate dollar value Hot Chamber	Approximate dollar value Cold Chamber	Total
Under 100	138	7	1,725,000	80,500	1,805,500
100-250	39	13	682,500	240,500	923,000
251-400	36	34	900,000	850,000	1,750,000
401-500	17	11	476,000	374,000	850,000
501-750	19	37	703,000	1,665,000	2,368,000
751-1000	7	28	434,000	1,820,000	2,254,000
Over 1000	0	4		440,000	440,000
TOTAL	256	134	4,920,500	5,470,000	10,390,500

the sales of die casting machines since 1952, including the first half of 1961.

The value of these machines, broken down into hot and cold chamber machines is given in Table II. From the table we get another major expenditure of the industry of over $10 million.

How much metal is bought?

The U.S. Department of Commerce, Bureau of The Census gives the pounds of metals shipped as finished die castings. These figures include both shipments of jobbers and inplant transfers. This data is given in Table III.

Using average metal cost figures supplied by the metal supply industry it is possible to arrive at a dollar expenditure by the die casting industry for metal. These costs are given in Table IV. The figures are based on average prices from 1952 to 1960 and the metal consumption data given in Table III.

It is worth noting that the highest metal consumption in both pounds and dollars was in 1955, the year the machine industry sold the greatest number of die casting machines.

How much die steel is bought

From the survey results we found that the die casting industry is the largest single consumer of hot work die steel. Figures show that:

Jobbing shops average 17,900 lbs. per shop per year.

Captive shops average 7,900 lbs. per shop per year.

For the entire industry this represents a purchase of 16,500,000 lbs. per year. Total production of these steels in 1960, according to the AISI, was 22,100,000 lbs. Thus, the die casting industry consumed 74% of the hot work die steel produced.

Based on an average price of $0.50 per pound, this represents die steel purchases of $8.25 million.

How much is spent for dies?

Some figures are available on the value of die casting dies shipped by independent tool and die makers. These are:

1958(1)	$44,991,000
1959(2)	50,000,000
1960(2)	57,500,000

(1) Source: U.S. Dept. of Commerce, Bureau of The Census

(2) Source: estimate by the National Tool Die & Precision Machining Association.

According to the NTDMA these figures represent about 53% of the tool and die shops. No inplant figures are available. No reliable estimate of the total value of die casting dies can be made, but it is very safe to assume that it is in excess of $100,000,000.

How much fire resistant fluid is bought?

Since 1954, when the first figures were collected, the annual sales of fire resistant hydraulic fluid have increased fairly steadily. Table V gives the annual sales in gallons and the approximate value based on an average price of $3.00 per gallon.

Value of miscellaneous materials and supplies

Goose necks

The industry average is one new gooseneck per hot chamber machine per year. At an average cost of $425 apiece, and with 5400 machines installed, this segment of the industry purchases is $2,295,000.

Crucibles and melting pots

The number of crucibles and melting pots used by the industry was given in the survey. Average prices per unit are those of several manufacturers.

Crucibles

Number bought per plant per year in jobbing shops	11.7
Number bought per plant per year in captive shops	9.8
Total for jobbing shops	8250
Total for captive shops	4600
Total for the industry	12,850
Average price per crucible	$110
Value of crucibles bought	$1,413,500

Melting Pots

Number bought per plant per year in jobbing shops	18.26
Number bought per plant per year in captive shops	5.76
Total for jobbing shops	12,875
Total for captive shops	2,708
Total for the industry	15,583
Average price per pot	$225
Value of pots bought	$3,506,175

Die and plunger lubricant

The average die casting plant buys 956 gallons of die and plunger lubricant per year. This is undiluted lubricant which the individual plant then dilutes to suit their own needs. This is, of course, only a fraction of the lubricant used since many die casters mix their own material such as soap, beeswax, paraffin, etc. However, using this average figure, we find for the die casting industry:

Total lubricant bought	1,123,300 gal.
Average price per gallon	$2.00
Value of industry purchases	$2,246,600

Total known expenditures

Obviously, all of the expenditures of the die casting industry have not been listed. Such items as gas, oil, power, water, maintenance and many others have not been determined. But even without these items the expenditures of the industry are impressive. Here's a recap of those we have detailed:

Wages	$575,480,032
Die Casting Machines	10,390,500
Metal	185,900,000
Die Casting Dies	100,000,000*
Fire Resistant Hydraulic Fluid	2,817,000
Melting Kettles	3,506,175
Crucibles (pots)	1,413,500
Goose Necks	2,295,000
Die and Plunger Lubricant	2,246,600
TOTAL	$884,048,807

*This figure is considered as very conservative for the value of dies made by jobbing tool shops.

TABLE III

POUNDS[1] OF CASTINGS SHIPPED BY INPLANT AND JOBBING DIE CASTING SHOPS

Metal[2]	1952	1953	1954	1955	1956	1957	1958	1959	1960
Aluminum	169.7	239.3	231.4	356.0	376.2	373.6	292.6	369.0	361.6
Zinc	405.6	515.0	466.7	722.8	681.2	659.3	503.1	648.1	614.5
Copper base	8.3	10.1	6.5	8.5	10.0	10.9	10.2	14.2	13.4
Magnesium	—	6.1	4.8	5.9	4.9	4.1	3.2	6.4	7.6

[1] Figures in millions of pounds.
[2] Figures do not include metal used for alloying.

TABLE IV

VALUE OF METAL SHIPPED AS CASTINGS[1]

Metal	1952	1953	1954	1955	1956	1957	1958	1959	1960
Aluminum	44.1	62.2	60.2	92.6	97.8	97.1	76.1	95.9	94.0
Zinc	56.8	72.1	65.3	101.2	95.4	92.3	70.4	90.4	85.5
Brass	2.5	3.0	1.9	2.6	3.0	3.3	3.1	4.3	4.0
Magnesium	—	2.0	1.5	1.9	1.6	1.3	1.0	2.0	2.4
TOTAL	103.4	139.3	128.9	198.3	197.8	194.0	150.6	192.6	185.9

[1] Figures in millions of dollars.

Note: Average prices used—Aluminum 26¢/lb., Zinc 14¢/lb., Brass 30¢/lb., Magnesium 32¢/lb. Above figures do not include normal metal losses which may run from 3% to 10% depending on melt shop efficiency.

TABLE V

SALES OF FIRE RESISTANT HYDRAULIC FLUID

Year	Total Sales	Sales to Die Casting Industry	% of Total Sales	Dollar Sales to Die Casting Industry
1954	512,000	336,000	64.4	$1,008,000
1955	910,000	601,000	65.2	1,803,000
1956	1,318,000	842,000	63.9	2,526,000
1957	1,349,000	827,000	61.3	2,481,000
1958	1,287,000	659,000	51.2	1,977,000
1959	1,807,000	939,000	52.0	2,817,000
1960[1]	1,757,000	779,000	—	—
1st half 1961[1]	866,000	385,000	—	—

[1] 1960, 1961 figures incomplete. One major supplier is not included.

The above figures are known to be on the conservative side. Some companies build all or part of their own die casting machines. The value of these machines is not included in these totals. Again many companies reported only the die steel they used in their own tool rooms so that their total consumption of hot work die steel had to be estimated and was deliberately estimated low. Die and plunger lube as well as many other items bought by the industry are, in some cases, "home-made" and hence the value can not be included in this tabulation.

How will the industry expand?

The growth and health of an industry is best measured by its plant expansion. This does not mean new companies coming into the field, but rather an orderly expansion of existing establishments.

While there may always be room for newcomers in an industry, it is unfortunately true that too many of the new plants are after a quick profit. Such expansion does an industry more harm than good.

For a true picture of the expansion in the die casting industry, we have therefore turned to the existing plants and asked for their plans; these are shown in Table I.

TABLE I—NEW EQUIPMENT PURCHASES

	Jobbers	Captives*	Total
Die Casting Machinery			
(No. of plants reporting)	71	21	92
Hot Chamber	71	21	92
Cold Chamber	72	24	96
TOTAL	143	45	188
Trim Presses			
(No. of plants reporting)	48	13	61
Mechanical	39	5	44
Hydraulic	72	15	87
TOTAL	111	20	131
Furnaces			
(No. of plants reporting)	41	12	53
Breakdown	62	19	81
Holding	57	15	72
TOTAL	119	34	153
Machining Equipment			
(No. of plants reporting)	180	45	225
Yes	95	24	119
No	85	21	106
Finishing Equipment			
(No. of plants reporting)	169	47	216
Yes	36	15	51
No	133	32	165
Material Handling			
(No. of plants reporting)	173	50	223
Yes	68	17	85
No	105	33	138
Toolroom Equipment			
(No. of plants reporting)	188	53	241
Yes	62	18	80
No	126	35	161

* Note: These figures represent both captive and job/captive combined.

There are several significant features in this report of anticipated expansion.

For the first time, proposed purchases of cold chamber machines is above the proposed purchases of hot chamber machines. Over the past several years hot chamber machines have considerably outsold cold chamber machines. Note also that while the plurality of cold chamber units is not great, most of it is in captive installations. This is probably indicative of the greater use of large aluminum die castings by the automotive industry.

A reversal of previous trends is also apparent in the purchase of trim presses. We saw in the review of installed equipment that mechanical trim presses far outnumber hydraulic presses. Now we see that companies plan to buy almost twice as many hydraulic presses than they do the mechanical presses. Here the probable reason is the greater flexibility of the hydraulic presses coupled with the much higher speeds of ram travel now available as compared with older hydraulic presses.

With the greatly increased competition in the die casting industry, many companies are finding that the profit on trimmed die castings is steadily declining. This probably accounts for the fairly large number of companies who plan to add machining and finishing facilities. Manufacturing cost reduction programs underlie the proposed installation of material handling equipment.

Significant also is the fact that more and more companies are using value analysis prior to requests for bids. In many cases these analyses have shown that die cast parts are "the best buy" provided there is not a serious division of responsibility.

It has been common practice to buy trimmed die castings from one vendor, machine the castings, and then send them outside for surface finishing, especially when a chromium plated finish is required. When this policy is followed, there has been constant friction between the vendor of the castings, the purchaser and the plater. The result has been rejection of die casting as a method of manufacture.

Now with the die caster installing more and better machining and surface finishing equipment there is no division of responsibility. If the castings are not up to specification when delivered, there can be no finger pointing—only one vendor is responsible. Tempers are saved, more harmonious relations exist between buyer and vendor, and perhaps most importantly, costs are reduced. If no other saving is gotten, there is no longer the back and forth shipment of rejected castings. Scrap is generated in the vendor plant and when finished castings leave the shipping dock they are normally up to requirements. This is especially true when statistical sampling and inspection are involved.

Quite apparently any projection of these expansion plans is impossible.

THE INVESTMENT CASTING INDUSTRY

COMPARED with the other PMM industries, investment casting is a youngster. But young as it is, the need for it is evidenced by its rapid rate of growth.

Prior to World War II, this fabricating method was mostly a tool of the jewelry, dental and art statuary industries. Today, its gross sales without these three applications is over $100 million. From its beginnings as a method of making blades and vanes out of non-machinable alloys, the products go into virtually every industrial manufacturing group.

Without counting the companies who are exclusively in the jewelery, dental and art statuary fields, there are approximately 160 investment casting foundries in operation. They range in size from two or three man shops to those employing from 1500 to 2000. In dollar sales they vary from as little as $10,000 per year to those with multi-million dollar gross sales per year.

Statistics for this industry are hard to secure. This may be because there is a larger than usual number of very small establishments which do not keep sufficiently detailed records.

A further complication to the gathering and projection of statistics is the almost complete absence of a reasonable number of medium sized shops. Well over 50% of the investment casting foundries employ fewer than 75 people while a very appreciable percentage employ over 1000. Under these conditions, even dollar sales per production employee become almost meaningless.

In a survey just made by PRECISION METAL MOLDING we tried to determine the gross sales, by industry consuming group, of the investment casting industry. Out of 160 companies questioned, 40 replied and of these 33 gave us detailed enough information to use. The results of this survey are shown in Table I.

It should be noted that the sales figures reported in Table I do not include reports from any company which does a majority of its business in the vane and blade field. The reporting companies are only those with a broad general sales pattern.

If we group manned aircraft and missles and rockets together they represent the largest single customer for the industry; about 50% of the sales reported.

TABLE I—SALES OF INVESTMENT CASTINGS—1960*

INDUSTRY GROUPS	Sales, Ferrous Castings, Dollars	Sales, Non-Ferrous Castings, Dollars	Sales, Super Alloy Castings, Dollars	Total Sales Dollars	% of Total
Automobiles & trucks	197,699	35,000	12,000	489,099	1.07
Aircraft (manned)	11,982,916	2,478,000	2,465,000	22,222,916	48.71
Ships & boats	27,400	37,000	40,000	104,400	0.23
Outboard motors	17,164	—	—	17,164	0.04
Trailers	47,000	10,500	—	57,500	0.13
Turbines (except aircraft)	12,100	—	—	18,500	0.04
Electric motors	61,580	29,286	—	197,166	0.43
Engines & motors, not elsewhere classified	2,623,274	721,000	195,000	3,539,274	7.75
Industrial & commercial tools & machinery	1,755,730	512,921	205,000	3,568,251	7.82
Electronic devices & communications equipment	734,280	2,053,271	100,000	4,088,851	8.96
Office equipment & business machines	112,750	66,186	5,000	545,666	1.20
Plumbing & heating equipment	73,790	120,662	10,000	493,352	1.08
Builders hardware	34,580	10,324	—	44,904	0.10
General hardware & tools	166,270	12,907	45,000	224,177	0.49
Scientific, Photographic, Optical, medical & recording devices	127,760	106,130	250,000	1,375,990	3.01
Timing & time operated devices	700	16,800	—	17,500	0.04
Home appliances	3,580	301,324	—	420,304	0.92
Toys, jewelry, sporting goods, etc.	130,370	407,486	—	537,856	1.18
Missiles & rockets	3,692,000	1,675,000	58,000	5,665,000	12.41
Ordnance items	608,340	580,455	—	1,428,795	3.13
Lighting equipment	23,270	29,407	—	96,177	0.21
Architectural products	2,000	—	—	2,000	0.004
Furniture	—	6,500	—	6,500	0.01
Agricultural machinery	—	—	—	116,900	0.26
Electrical equipment	—	—	—	274,400	0.60
Primary metal	—	—	—	77,100	0.17
TOTALS	22,434,583	9,210,159	3,385,000	45,629,742	

* Total sales (by industry group) of 33 companies out of 40 responding.

The failure of the gas turbine to develop as rapidly as predicted a few years ago probably accounts for the small sales in the non-aircraft turbine field.

The survey shows some industry groups where only very small sales are recorded. This could represent saturation, but more probably indicates areas where greater market development work is required. Some of these fields, furniture and architectural products for example, probably will never develop very much. They may be classed as splinter groups. Builders hardware, however, now seems to represent only 0.2% of the total sales and could become an important market for the investment caster.

A study of Table I will probably disclose a number of potential markets for investment castings. All of those industry groups which buy less than 1% of the total may be potential markets. Some, of course, are so-called splinter markets where sales may be limited to highly specialized products which are not characteristic of the industrial group.

Of the 23 industrial groups listed, 13 are in the less than 1% group and account for a total of only 4.29% of the industry sales. In the group buying between 1% and 5% there are 5 industry groups which account for 11.6% of the total sales. The four groups whose purchases range from 5% to 20% buy 46.51%.

It would seem, then, that within the 18 industrial groups whose purchases are under 5% of the total dollar volume there should be additional markets and possibly fairly large markets. Here, very easily, could be the area of major future expansion for the investment casting industry.

THE POWDER METALLURGY INDUSTRY

LITTLE DATA have been published on the apparent size of the powder metallurgy fabricating industry.

While no acceptable figures are available, it is probable that the gross sales of the industry are over $100 million annually. This sales figure is for structural parts and bushings only. Electronic cores, friction materials, cemented carbides, and tungsten and molybdenum products are not included.

This multi-million dollar market is shared by about 190 companies which vary in size from the smallest with only two employees to those with 2000 to 3000 employees.

To get some idea of the size of the industry, PRECISION METAL MOLDING surveyed the entire fabricating industry. Out of 187 plants questioned, 59 (31.5%) answered at least in part. About the only figures which can not be projected for the entire industry are the dollar sales. In this case, the companies who submitted figures did not represent a sufficiently good cross section to permit projection.

Let's see, then, what the survey actually showed and how it projects to the entire industry.

How old are the fabricating companies?

Of the 59 companies who reported, the youngest is only 1 year old and the oldest 40 years old. The distribution by age is:

less than 5 years	7 companies
5 to 10 years	22 companies
11 to 15 years	10 companies
16 to 20 years	10 companies
over 20 years	10 companies

How many presses are installed?

Out of 49 companies reporting on this question, 48 gave us data on the types of presses installed. This showed 327 mechanical presses and 84 hydraulic presses. These were distributed by size as:

Tons rated capacity	Mechanical presses	Hydraulic presses	Total
under 25	149	7	156
25 to 50	83	5	88
51 to 100	60	15	75
101 to 150	20	6	26
151 to 200	10	13	23
over 200	5	38	43
Totals	327	84	411

One company reported a total of 22 presses without any type breakdown so that the total presses reported is 433.

Average per company	8.83
Minimum total for the entire industry	1651

The same data was collected on sizing (coining) presses. Here 31 companies reported, with a type breakdown of:

Tons rated capacity	Mechanical presses	Hydraulic presses	Total
less than 25	31	9	40
25 to 50	41	8	49
51 to 100	21	7	28
101 to 150	3	1	4
151 to 200	1	0	1
over 200	1	4	5
Totals	98	29	127

Average per company	4.90
Minimum total for the entire industry	916

How old are the presses?

Almost 6% of the presses now in operation are more than 20 years old while 37% are less than 5 years old. The age breakdown given by the companies replying is:

Age of presses in years	Number
under 5	185
5 to 10	179
11 to 15	80
16 to 20	20
over 20	29

How many furnaces, gas generators, etc.?

The survey showed 160 fuel fired furnaces installed, 339 electrically heated furnaces in operation. This gives a minimum total for the industry of 499 furnaces.

Associated with the furnaces are 504 atmosphere generators.

There are 412 powder blenders and 333 impregnating units in use.

Note that all of the figures given for the entire powder metal fabricating industry are minimum figures.

Of the 47 companies who answered, 23 plan some plant expansion in the near future or have already done some expanding this year.

Nearly all of the companies who cooperated in this survey use some carbide tooling, and a solid 26.5% report that 100% of their tooling is in carbide. The distribution among respondents was:

Percentage of tooling in carbide	Percent of replies
under 10	14.3
11 to 25	34.7
26 to 50	22.5
51 to 75	2.0
76 to 100	26.5

What are the industry's sales?

While a substantial number of companies replied to this question, the distribution was such that no projection for the entire industry can be made. It is known that the dollar figures, when converted to average sales per plant, are low. However, even though no industry wide figures can be arrived at, the distribution by consuming industry group is probably fairly valid. This distribution is shown below:

INDUSTRY GROUPS	FERROUS PARTS	NON-FERROUS PARTS	SUPER ALLOYS	TOTALS
Automobiles & trucks	$234,972	$104,000		$338,972
Aircraft (manned)	29,000	22,254		51,254
Ships & boats				
Outboard motors	30,000	10,000		40,000
Trailers				
Turbines (except aircraft)				
Electric motors	32,522	55,000		87,522
Engines & motors, not elsewhere classified	32,669	15,000		47,669
Industrial & commercial tools & machinery	142,940	161,000		303,940
Electronic devices & communications equipment	322,000	164,584	50,000	536,584
Office equipment & business machines	119,424	57,819	25,000	202,243
Plumbing & heating equipment	195,000	5,000		200,000
Builders hardware	25,000	35,000		60,000
General hardware & tools	76,000	475,000		551,000
Photographic, Optical, medical and recording devices	165,936	8,452		174,388
Timing & time operated devices	77,326	11,988	4,000	93,314
Home appliances	180,000	78,000		258,000
Toys, jewelry, sporting goods, etc.	34,000	27,500		61,500
Missiles & rockets	1,000	5,000		6,000
Ordnance items	15,000	305,000	18,000	338,000
Lighting equipment				
Architectural products				
Furniture	1,500	72,321		73,821
Agricultural equipment	7,500	100,000		107,500
TOTALS	$1,721,789	$1,712,918	$97,000	$3,531,707

THE EXTRUSION INDUSTRY

UNFORTUNATELY, statistical data for the extrusion industry are few and quite scattered. While there is some information available on the aluminum extrusion industry there is practically none for the copper, brass, bronze, and steel extrusions.

U.S. Department of Commerce reports show 148 aluminum extrusion plants operating in 1959, an increase of 51% over 1954. These plants were located in 27 different states with 42, or 28.4%, of them in Ohio and Michigan.

The installed presses range in size from less than 1000 tons capacity to over 7000 tons capacity. The breakdown by size of presses is:

Press Size (Tons)	No. of Presses (1959)
Under 1000	69
1001 to 1499	113
1500 to 1999	30
2000 to 2999	107
3000 to 3999	19
4000 to 4999	12
5000 to 6999	4
7000 and over	7
Total	361

These presses are all for the extrusion of aluminum.

Over the period 1953 to 1960 the amount of aluminum extruded rose from 393.1 million pounds to 850.7 million pounds, an increase of about 120%. In 1960, the minimum value of these aluminum extrusions was $357 million. This is based on the average selling price of solid aluminum shapes. Since hollows are about twice as expensive as solids, this value is known to be low.

Where do aluminum extrusions go?

It is the concensus among aluminum extruders that about ⅔ of the extrusions made go into window and door manufacture or into architectural products. If this is true, the question then comes up: Where does the other half of the extrusions go? To find this out, PRECISION METAL MOLDING selected a group of extruders who were known to have a broad general sales pattern outside the two industry groups noted above. We gave these producers lists of industries and asked them to break their sales down among these industries. The results of this very limited survey are shown in Table I.

Of the group of extruders selected, one company noted that they had sales in a number of industrial groups not listed. Another noted that since most of their sales were through distributors it was difficult to give an accurate breakdown. Finally, it should be noted that only independent extruders were included. Had any of the integrated companies been included the results would have been quite different.

What does the survey show?

Fragmentary though this survey was, it still shows that there exists a wide industrial market for aluminum extrusions. It further shows that the aluminum extrusion industry has a major task ahead of it to educate designers to use extruded shapes more widely.

All of the companies questioned are of about the same size as far as number of presses, size of presses, and auxiliary services are concerned. Some of them

TABLE I

PERCENTAGE PURCHASES OF ALUMINUM EXTRUSIONS BY CONSUMING INDUSTRY GROUPS

Consuming Industry	Sales by Extruders min. %	max. %
Automobiles & Trucks	1	2
Aircraft (manned)		1
Ships & Boats	5	10
Trailers		5
Industrial & Commercial Tools & Machinery	2	2
Electronic Devices, Communication Equipment	10	100
Office Equipment & Business Machines	1	10
Plumbing & Heating Equipment		10
Builders Hardware	7	10
General Hardware & Tools	5	15
Photographic, Optical, Medical & Recording Devices		1
Timing & Time Operated Devices		0.5
Home Appliances	4	40
Toys, Jewelry, & Sporting Goods		5
Lighting Equipment	5	15
Furniture	5	30
Store Fixtures	1	10
Food Handling & Preparing Equipment		10

Note: Where only one figure is given the replies from all extruders who sell in this market were identical. Sales are in percent of dollars of total sales; % min. is the lowest percentage reported and % max. the highest percentage reported among all of the cooperating companies. No set of figures applies to any single producer. Not all companies sold to all consuming industrial groups.

TABLE II

TOTAL INDUSTRY SURVEY RESULTS (preliminary report)

Number of companies responding (usable replies only)	111
Number of companies who make extrusions for sale (contract shops)	108
Number of inplant extruders (no outside sales)	3
Number of companies both contract and inplant	51
Number of companies exclusively contract (no in plant transfers)	59
Number of companies who make straight extrusions	98
Number of companies who make impact extrusions	13
Number of companies who have proprietary shapes	54

Number of companies who extrude the following metals:

	Straight Extrusions	Impact Extrusions
Aluminum		
Soft alloys	82	11
Hard alloys	33	11
Beryllium	2	2
Brass	10	5
Bronze	8	3
Copper	8	6
Lead	2	1
Magnesium	3	3
Silver	2	2
Steel (low carbon)	7	6
Steel (high carbon, stainless)	8	3
Tin	1	2
Titanium	5	2
Uranium	1	2
Zinc	0	2
Zirconium	5	2

Number of companies that do inplant machining on extrusions	94
Number of companies that do inplant surface finishing on extrusions	68
Number of extrusion companies who sell billets to others	14
Number of companies who make their own tooling	70

do practically no window and door business and some extrude no general architectural products regularly. These are the companies who show the highest percentages of their output in the industrial products listed in Table I. This would indicate that there is an active industrial market for aluminum extrusions. Furthermore, most of the extruders with whom we talked felt that the market for aluminum extrusions among general industrial and consumer product manufacturers has only been scratched.

A further incentive to develop these markets is the generally higher price per pound that these extrusions bring than is the case with window and door or architectural shapes.

Total industry survey

Preliminary results are now available on an industry-wide survey. Out of approximately 250 companies that do extrusion of some sort, 111 usable replies have been received.

A tabulation of the results of the survey is given in Table II. Since some companies did not answer all of the questions not all of the totals equal the number of replies. Also in the listing of metals that these companies extrude the totals are considerably higher than the number of replies since some companies regularly extrude more than one metal.

The very small number of strictly captive (inplant) extrusion operations is probably due to the very large capital investment required for even a small installation and the ability of the custom extruder to make short runs quickly and economically. It is this ability to make short runs which distinguishes the extrusion industry from all of the other PMM industries except plaster mold casting where the same condition prevails.

The dollar sales of the extrusion industry are not known at this time and it is probable that they will not be known, at least for several years. This is due largely to lack of separation of product classes; particularly in the extrusion of copper and copper base alloys.

In the aluminum extrusion industry the average independent extruder with one extrusion press of about 1200 tons capacity and the necessary auxiliary equipment has a minimum capital investment without buildings and ground of about $300,000 if no surface finishing facilities are installed. Such an operation, if about 50% of the output goes into architectural products, windows and doors has gross annual sales of about $1.0 to $1.5 million. As the percentage of architectural products, windows and doors goes down and if the weight of metal pushed stays up, sales will be in excess of the 1.5 million dollar figure.

A few of the extruders, mostly in soft aluminum alloys, either plan some expansion or are now expanding. For the most part, however, capacity through the entire industry is far in excess of demand. It is probable that most extruders are currently working at from 50% to 70% of capacity.

What can be expected, before any active expansion takes place, is moderately widespread plant modernization. Many of the extruders are contemplating the installation of more efficient auxiliary equipment and new materials handling equipment. This is all designed to increase productivity per man-hour as labor rates continue to advance.

What's ahead

It is probable that the aluminum and red metal extrusion industries will have to wait for consumption to catch up with plant capacity. This may take several years. In the meantime, an agressive market development program is indicated to broaden the use of extruded shapes in industry groups that are not using any extrusions or are not using as many as they could.

Probably the brightest picture in the entire extrusion industry is in the ferrous metals. The current aircraft program (see PMM, August, 1961) is giving tremendous impetus to the use of extruded steels.

The important thing about this program is that special steels are being developed for aircraft use which can, and will, find many applications in industry. While the use of these steels may be too small to permit rolling, they are specifically tailored to be extruded. As the techniques are more fully developed closer tolerances will be gotten so that the full advantage of the extrusion process can be used.

WHAT'S NEW IN SURFACE FINISHING?

Parts made by one of the PMM processes are usually easier and cheaper to surface finish than parts made by other methods.

But even so, existing methods of surface finishing leave much to be desired. Chromium plating on zinc die castings is still relatively expensive if the most durable coating is applied. No really good, or economical, method for chromium plating aluminum has been developed which does not require a zincate film over the aluminum. This zincate film does not have as good bonding to the basis metal as is desired. Further, it's more expensive than plating directly onto a zinc die casting since the one extra step is involved.

As yet there is no adequate method of color anodizing aluminum die castings. Colors are streaked and muddy in most cases, though several processes seem to give an acceptable black.

Paint and lacquer can be very successfully applied to both zinc and aluminum parts, but for the best results a chemical conversion coating must first be applied. This, of course, means added costs.

Considerable progress is, however, being made. Let's review some of the developments that have come in the recent past.

Mechanical finishing

The relatively new vibratory finishing technique is continuing to gain. Equipment is still much more expensive than the older rotating barrel finishing equipment, but the increased speed of processing seems to compensate in many cases. The consensus seems to be that the surface secured by vibratory finishing is not quite as good as with barrel finishing. In many, possibly in most, cases this is not important.

Both barrel and vibratory finishing are under intensive study to increase the precision with which such operations as deflashing, deburring, radiusing, etc. can be done.

Chromium plating zinc die castings

One of the major fields of investigation in the Expanded Research Program of the zinc industry is to develop a better and less expensive method for chromium plating zinc die castings. This research has shown that both duplex, or crackfree, chromium have superior corrosion resistance when compared with ordinary, low temperature chromium plates. Duplex nickel under ordinary chromium plate has also shown improved corrosion resistance.

Accelerated corrosion tests can now be correlated with both service and exposure tests with better accuracy and reliability.

A new chromium bath for depositing duplex chrominum, identified as a tetrachromate bath, is reported to deposit chromium over a broader bright plating range compared with other solutions for depositing crackfree chromium.

Plating on aluminum

Up to now, a zinc film must be deposited on aluminum before it can be electro-plated.

Most zincate baths for this purpose deposit a film with rather poor adhesion, have bad drag-out characteristics, suffer from water dilution, and do not penetrate into grooves, blind holes and threads.

A new zincate bath developed by Enthone, Inc. is reported to have none of these faults. This bath is about the same viscosity as water, is not badly diluted by residual water on the aluminum parts when they come from the cleaner and rinse tanks, penetrates well and has far less drag-out than conventional baths. The adhesion of the zinc film is reported to be considerably greater. Time of immersion varies from 15 seconds to 2 minutes depending on the parts being treated. The plating cycle, after zincate treatment, is quite normal.

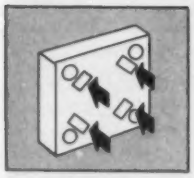
Anodizing die castings

Progress in this field has been slight. Several die casting companies are capable of making and color anodizing aluminum parts, but for the most part they are vacuum casting and anodizing very high purity metal. Commercial applications are still a long way off except for items that can carry a high price tag. A notable example is die cast and anodized eye-glass frames. Even with the high costs of metal and production, these frames undersell forged and machined frames. Active research is known to be going on in a number of metal supply company laboratories and among some die casters, but so far there have been no significant commercial developments.

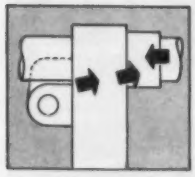
Porcelain enameling on aluminum

Partly through the Expanded Research Program of the Lead Industries Association and partly through private company research, a whole new series of low temperature frits have been developed which permit the porcelain enameling of aluminum castings and extrusions. Older, high temperature frits caused warping and distortion of the parts, blistering was also

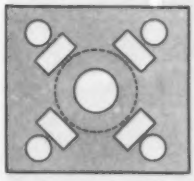
continued on page 112



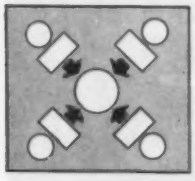
1. Each corner link is a strong, self-contained support for both plate and die.



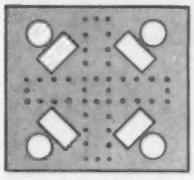
2. Short and direct transfer of loads on each corner minimizes bending stresses on the moving die platen and back plate.



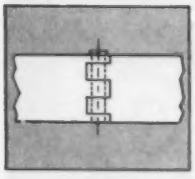
3. Reduces the area of unsupported moving die plate. Helps eliminate flashing and potential cracking of dies.



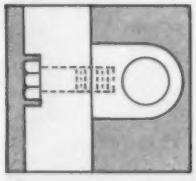
4. Prevents weaving of the link center axis (crosshead) and consequent unequal loading.



5. Permits a large area of both horizontal and vertical bumper pin ejection pattern.



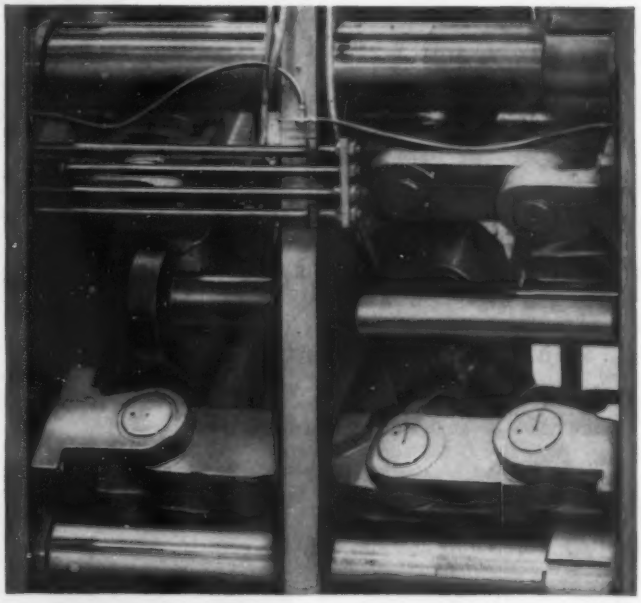
6. Corner positioning of each link assembly results in equal and straight line loading of all pins and bearings in the link pivots.



7. Toggle anchors are bolted to the back and traveling platens. They are not subject to weld breaks or breakage as part of a casting.

FOUR-CORNER LOCK-UP

in Greenlee–B&T die casting machines offers you 7 benefits



Only in Greenlee — B&T Die Casting Machines will you find this unique toggle locking mechanism. Investigate its many advantages that help give you greater holding power, best die alignment and lower maintenance. Your Greenlee — B&T representative will be glad to arrange for a demonstration.

. . . OTHER GREENLEE — B&T DESIGN ADVANTAGES

- Improved Hydraulic System
- Three Stage Variable Speed Shot Control
- Automatic Lubrication, Die Lubrication and Ladling
- Motorized Die Height Adjustment

COMPLETE LINE OF B&T TRIM PRESSES

"DON'T MISS THE BOAT . . .
GET A B&T QUOTE"

PRODUCTION MACHINERY
GREENLEE B&T

B&T MACHINERY COMPANY
A DIVISION OF GREENLEE BROS. & CO.

217 W. EIGHTH ST.
HOLLAND, MICHIGAN
phone EXport 2-2341

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC TOOLS FOR CRAFTSMEN

Circle 13 on Reader Service Card

LET

Superior

DEVELOP YOUR ALUMINUM "TRIM IDEAS"

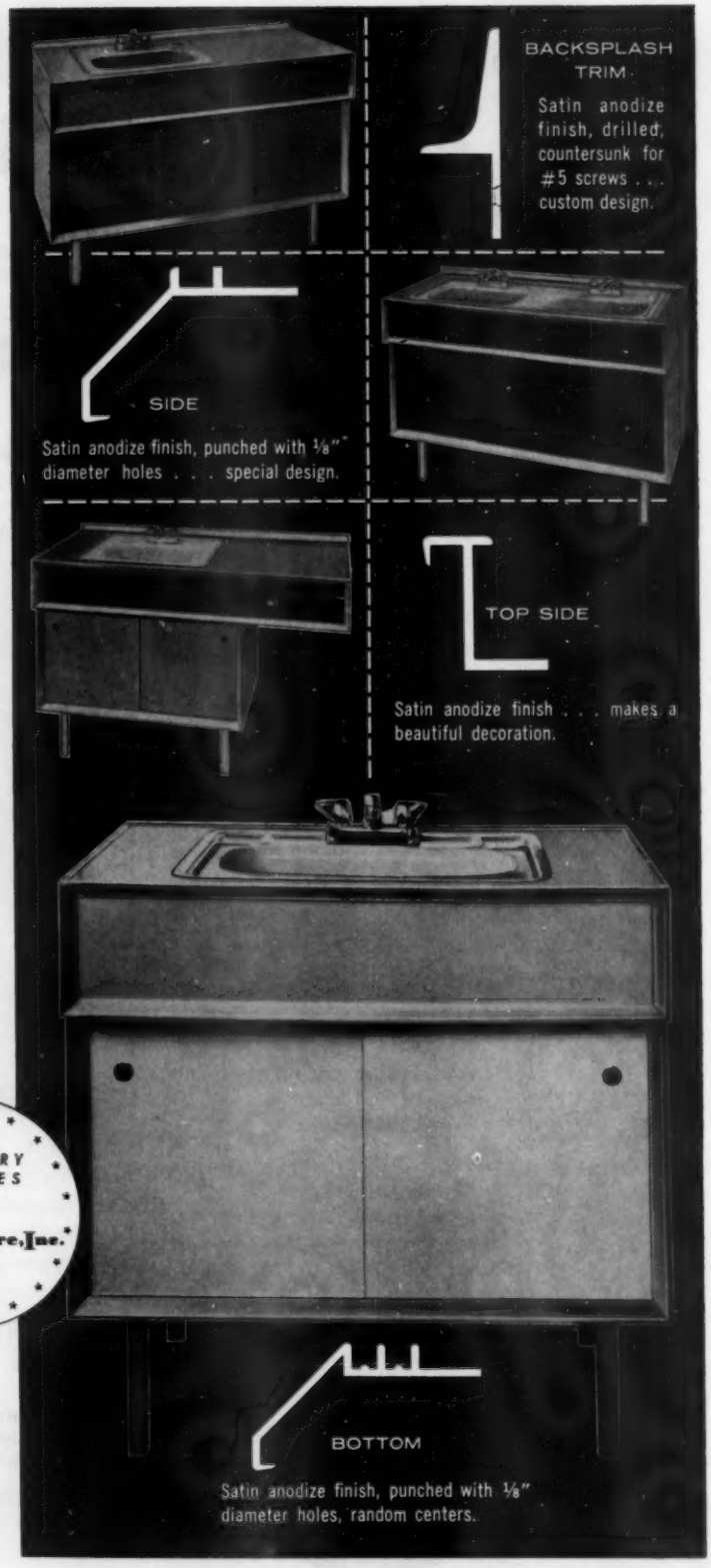
Here's how one company used Superior Industries' engineering services and production facilities in planning its metal trim requirements for a new product.

. . . and it wound up with beautiful, special designs to match functional and decorative requirements of an exquisite AllianceWare lavatory vanity.

Peter Muller-Munk Associates designed the AllianceWare vanity and also the aluminum trim. Superior was called upon to meet the specifications and match uncompromising mechanical accuracy and finish.

Under one roof, Superior miters, bends, rivets, drills, countersinks and notches the metal. Chemical and hand polishing, spray painting, and anodizing get professional attention.

Thousands of companies have used Superior's facilities. So give it a try . . . send samples, blueprints or ask us to call.


BACKSPLASH TRIM
Satin anodize finish, drilled, countersunk for #5 screws . . . custom design.
SIDE
Satin anodize finish, punched with ⅛" diameter holes . . . special design.
TOP SIDE
Satin anodize finish . . . makes a beautiful decoration.
BOTTOM
Satin anodize finish, punched with ⅛" diameter holes, random centers.
LAVATORY VANITIES BY
AllianceWare, Inc.

ALUMINUM EXTRUDERS • ANODIZERS • ARTRIM MOULDINGS

SUPERIOR INDUSTRIES INC.

3788 OAKWOOD AVENUE • YOUNGSTOWN, OHIO

Circle No. 67 on Reader Service Card

SINTERED INSERT SHAVES COST OF DIECAST ENGINE FLYWHEEL

By **HENRY LEFER**, *Eastern Editor*

SCREW MACHINES can spit parts out almost as fast as you can count them.

But if the design has elements that can't be turned simply on a lathe, you may run into profit-shaving secondary operations, such as milling and broaching. By redesigning for sintering, you often can eliminate secondary machining, and produce a strong, precision part at a lower cost. When production runs well into six figures, the saving can be considerable.

This was the case with the hub insert used by R. E. Phelon Co., Inc., in the flywheel for its Lauson engine. The engine is a single-cylinder powerplant used in lawn mowers, small scooters, and similar machines. It comes in sizes from 2½ to 5 hp.

ZINC FLYWHEEL die cast around powder metal insert. Posed in foreground is an insert.

The flywheel is a zinc die casting. To provide a firm bearing which will not work loose on the shaft, the flywheel is cast around a steel insert.

The insert used to be screw-machined from cold-rolled steel hexagonal stock, leaving, in alternate versions, a hex collar around the center or at both ends of the piece. The hexes locked the insert against rotation in the flywheel. The profile was such as to prevent it from being pushed out of the flywheel.

It required the additional operations of drilling and reaming an internal diameter, and broaching an internal keyway by which the flywheel could be locked to the shaft.

Redesigned as a sintering, the insert is formed in a single operation. To get the maximum benefit from the switch to powder metallurgy, Phelon's chief engineer, William Henschke, and Dixon Sintalloy, Inc., worked out a new design for the insert. The original design did not lend itself to powder metallurgy because of variations in the outside diameter which were not in the direction of pressing. The redesigned part has constant cross-section, except for chamfered ends which anchor it against in-and-out movement. Longitudinal ribs lock it against slipping in the flywheel. The keyway is formed at the same time.

Keyway width is critical —must be kept within 0.003"—but this is no problem in pressing.

The only machining Phelon does is to cut a slight taper in the I.D., so the flywheel can be pressfitted on the shaft.

The powder alloy used is 90% Fe, 10% Cu, chosen for its strength. It is pressed at about 35-40 tons/into a density of 63. gm/cc, then is sintered in a reducing atmosphere. No sizing or coining is required.

The stress on the insert is considerable, as the flywheel goes from rest to 3500-4000 rpm in less than 2 seconds. A torque of 25-30 ft-lb is developed.

To test the insert, Dixon Sintalloy developed a machine to apply a hoop burst test. In this test, a pin with a 60-deg. taper is forced down into the sintering's I.D. until it bursts. Phelon requires the part to withstand at least 7000 lb.

In a related test, the insert is contained within a flywheel casting and a tapered pin forced into it. The machined steel inserts fractured at 60,000 psi. The powder metal inserts fracture at 40,000 psi., well above the strength Phelon considers necessary for the job.

1. TYPICAL FILTER MATERIALS in tubular form. The tube machined on both ends may be threaded. The conical element is actually a cone for a shaped charge.

DESIGNING FOR POWDER

By T. L. ROBINSON, *President, Powdercraft Corp.*

FILTERS AND FILTER MATERIALS

This is the fifth in a series of articles by Mr. Robinson on the design of parts made from metal powders. Previous articles discussed the design of sprockets (PMM, May '61), gears (PMM, June, July '61), and cams (PMM, August '61). This article will be followed by an article on miscellaneous industrial parts. — Ed.

ONE OF THE FEATURES of powder metallurgy is its ability to make products which cannot be made by any other method. The well-known self lubricating bushings are an outstanding example as are the cemented carbides, cermets, heavy metal, and a few other products. To this group we can add filters and filter materials made of metal powders, figure 1.

What are the advantages?

Whenever a non-disposable filter material is required a metal powder product offers many advantages.

- A wide variety of materials of construction are available.
- Pore size can be easily and accurately controlled.
- Pressure drop across the filter is low and can be controlled.
- When necessary, cleaning is simple and effective.
- Selective filtration can be done.
- They can be machined easily.
- They are far less brittle than ceramics.
- They can be made in almost any desired shape.
- Generally, size is not a limiting factor.
- They filter in depth, rather than only on the surface.
- They remove particles much finer than the filter pore size due to the tortuous filter path.
- Filter materials can be joined together or to other components.
- Costs are generally low for the intended service.
- Filter materials are adaptable to a wide variety of other uses, both industrial and consumer.

What are the disadvantages?

Contrary to most of the powdered metal parts we

TABLE I—PROPERTIES OF SINTERED BRONZE FILTERS

Designation	Coarse	Medium	Fine	Extra Fine	Super Fine
Mean pore opening, inches	.0035	.0015	.0001	.00075	.0003
Mean pore opening, microns	90	40	25	18	7
Minimum tensile strength, PSI	4,000	5,000	6,000	7,000	7,000
Ductility % elongation	2	3	3	3	3
Density # per cu. in.	.17	.17	.17	.17	.17
Porosity %	47.15	47.15	47.5	47.5	47.5
Minimum practical thickness	.080	.060	.045	.030	.030
Type chemical analysis	95.5 Cu. 4.5 Sn	90.0 Cu. 10.0 Sn	90.0 Cu. 10.0 Sn	90.0 Cu. 10.0 Sn	90.0 Cu. 10.0 Sn
Screen mesh of powder	32-60	60-100	80-150	100-325	150-325

DIMENSIONAL TOLERANCES: (Length, Diameter or Thickness): ± .010/inch; ± .004 Minimum

METALLURGY

have discussed in previous parts of this series, sintered metallic filters have few disadvantages. Like every other component, improperly applied these filters are very costly, but properly used the advantages gained are so great that any small increase in manufacturing cost is outweighed by improved performance. If the designer is not completely familiar with these products he should consult a competent vendor before he specifies, or on the contrary fails to specify them.

For design purposes, here are three points which must be considered and might be classed as disadvantages of this material.

1 The ratio of effective porosity to total volume is rather low. While porosity in excess of 40% is usual, the balance is relatively expensive metal.

2 Because most of the pores are larger than the smallest throats, the total porosity is not effectively used. An ideal filter would have tubular pores of uniform diameter.

3 Porosity is isotropic and in most cases permeability in only one direction is required. However, careful design can frequently overcome this short coming so that the isotropic porosity can be fully utilized. Of particular value is that when one pore becomes blocked the isotropic nature permits bypasses to function effectively. This characteristic also gives a tortuous path which increases the effectiveness of the filter.

Let's examine, then, the many advantages these materials offer the industrial designer.

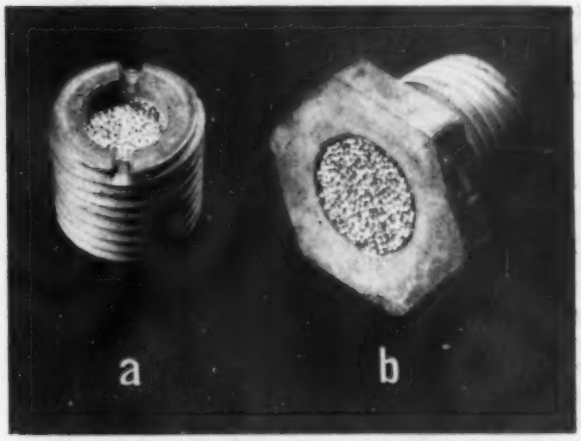
TABLE II—AIR FLOW THROUGH SINTERED BRONZE

Pressure Drop Inch Water	Air at 72°F; Flow in cu. ft./min./sq. in. Coarse	Medium	Fine	Extra Fine	Super Fine
.1	.15	.09	.05	.01	.006
1.0	1.0	.7	.40	.17	.05
2.5	1.8	1.3	.80	.40	.12
5.0	3.0	2.2	1.5	.80	.25
10.0	4.0	3.4	2.4	1.4	.50
20.0	6.0	5.5	4.5	2.5	1.0
40.0	8.6	8.0	6.0	4.0	2.0

Materials

Almost any metal which can be made into spherical or near-spherical powder particles can be used. At the present time, such materials as aluminum and magnesium present a serious atmosphere control problem in the sintering furnace. This problem has not yet been solved.

Most commonly, filter materials are made of iron, nickel, copper, brass, bronze and stainless steel. The noble metals, i.e. gold, silver, platinum, etc., can be and have been used in special cases.



2. FILTER MATERIALS applied to unusual jobs. Part "a" is a surge suppressor for an instrument in an hydraulic line and part "b" a breather plug for an engine crankcase.

The choice of material is dependent almost entirely on the environment in which the material must operate. Copper and brass are probably the most widely used, but the austenitic stainless steels enjoy considerable use.

Pore size

The size particle which can be filtered out depends to some extent on the pore size of the media. This pore size can be controlled, within limits, by the size powder used. Table I gives the physical and mechanical properties of some typical bronze filter materials ⅛" thick. In other words, these filter materials filter in depth rather than on a plane as is the case with cloth or wire mesh filters.

Pressure drop

Generally, the pressure drop across a sintered filter is low. It can be controlled by varying the thickness of the filter material. This method of control is why metallic porous filters have gotten such wide acceptance as surge supressors in hydraulic lines, particularly ahead of gauges. A typical plug for this service is shown in figure 2a.

When these filters are used on air or gas lines, the flow is relatively independent of filter thickness. It

depends entirely on the imposed pressure drop. With liquids, on the other hand, the flow is roughly proportional to the filter thickness. Tables II and III show typical flow rates for air and gasoline through filters ⅛" thick.

Cleaning

In most cases, cleaning of porous metallic filters is simple. Back-washing is often entirely effective and usually can be done without removing the filter element from the line.

When the contaminant is soluble in one of the organic solvents cleaning can be done by circulating the solvent through the element.

Finally, acid or alkali cleaners and/or solvents can be used. With these materials, however, be careful, to make sure that there is no attack on the metal from which the filter is made.

Selective filtration

Sintered metallic filters can be used for separation of different materials. Oil may be separated from water and refrigerants, water from oil and gasoline, and water from air and other gases. One exceptional use of these materials is the filtration of jet engine fuel to remove harmful contaminants.

The ability to make this separation depends on the interfacial tension of filtrants involved towards bronze or the plated surface. Since the difference in surface tension is altered by the metallic surface involved, it is possible to change it by electroplating the filter elements. In many cases an improvement of 200% to 300% has been found by the proper selection of the plating element. Cadmium, tin, or nickel are commonly used for this purpose.

Treatment of the filter with a selective wetting agent is also effective. By proper selection of a wetting agent the separation of two components can be made quite complete. When the use of a wetting agent is combined with a plated surface on the filter element a highly efficient job can be done. The designer should consult with his vendor for the best suggestions on both of these points.

This use of metallic filters is very important, but is only beginning to be widely used.

TABLE III
GASOLINE FLOW THROUGH SINTERED BRONZE

Liquid at 72°F; Sp. Gr. .731; Flow in gal./min./sq. in.

Pressure Drop PSI	PC-30 Coarse	PC-60 Medium	PC-80 Fine	Extra Fine	Super Fine
.5	7.0	2.0	1.5	.75	.3
1.0	13.0	5.5	3.0	1.5	.6
2.0	27.0	12.0	6.0	3.0	1.0
3.0	42.0	14.5	9.0	4.5	1.5
4.0	55.0	22.5	12.0	6.0	2.0
5.0	—	28.0	16.0	7.5	2.7
10.0	—	60.0	34.0	16.0	5.0

Machining

Metallic sintered filters are easily machined by all normal methods. Many filters are threaded at one end for attachment to other components.

Some modifiication of tool shape may be necessary to machine these materials and generally best results are secured through the use of cemented carbide cutting tools.

Remember, however, that machining will effectively destroy the filtering ability of the material since there is a layer of disturbed metal on the surface. Many of the pores will be either closed or partially closed. When necessary, a light surface etch on the machined area will restore most of the effectiveness.

Brittleness

Most metallic sintered filters are quite ductile. They have an elongation, in tension, of up to 15% in 2" and somewhat greater ductility in compression. This is one of the factors which distinguishes them from ceramic filters, their closest competitor.

Because of their ductility, metallic filters can be sized when necessary without altering the filtration characteristics appreciably. As normally made, commercial tolerances are ±0.010 in./in. This tolerance can be improved to a minimum of about ±0.004 in./in. by a sizing operation after sintering.

Metallic filters can be used under fairly high shock conditions which would fracture a ceramic material and might, conceivably, tear a cloth filter.

Shape

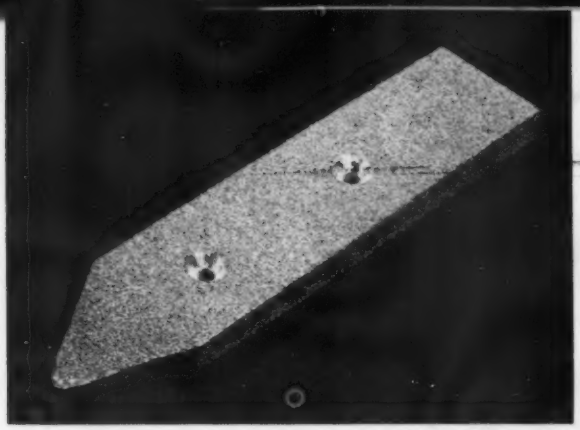
One outstanding advantage of metallic sintered filters is the wide variety of shapes that can be made. In fact, almost any desired shape can be made if a mold can be machined.

In the manufacture of filter elements, no pressure is used to compact the powders prior to sintering. In most cases the loose powder is poured into a mold and vibrated slightly to settle it firmly. Sintering is done with the powder in the mold.

For flat, plate type filters shallow trays, generally stainless steel, are used. Cylindrical and conical units are made in individual molds made of either cast iron or stainless steel. Since the compact shrinks during sintering, removal from the mold is no problem provided the mold surface has a refractory oxide coating. If stainless steel is used the chromium oxide film is an adequate barrier to prevent sticking. When cast iron is used, a grade containing an appreciable amount of chromium should be specified.

For more complex shapes and where production is limited, graphite molds are often used. These molds are satisfactory for most materials except stainless steel when carburization would destory the corrosion resistant properties.

While graphite molds are reusable, they have the added advantage of being expendable. Undercuts and even some re-entrant angles can be formed. Costs would be high, of course, because the mold would have to be destroyed to remove the filter.



3. A POROUS GROUND PLATE for ship-to-shore radio. This small plate replaces a copper strip six inches wide and several feet long.

4. A COMBINED WICK AND BURNER PLATE (spreader) for an alcohol lamp. Similar units are used in kerosene stoves and gas range broilers.

Size

About the only limitation on size is the size of the sintering furnace. Flat plate filters 14″ wide and from two to three feet long are commonly made for the chemical industries. Other large plates are those used for wind tunnels. These are 18″ wide and up to 15 ft. long. The width of the furnace is the limiting factor in making these plates since mold sections can be circulated and any desired length made as a continuous sheet of filter material.

Tubular filter elements are limited in diameter by the width of the furnace and in length by the depth. When price will permit, special pit type furnaces may be used for very long tubes. Tubes 2½″ in diameter and 12″ long have been made, and experimental work indicates tubes up to 22″ in diameter can be made.

Joining

Metallic filters can be joined by most conventional methods. We have seen that they can be machined and threaded. They can be drilled and tapped if necessary and can be welded, brazed and soldered. It is probable that some of the industrial adhesives will also work as joining materials.

Remember, though, wherever a joint is made the filtration characteristics will be destroyed or greatly changed.

Costs

For the job they do, sintered metallic filters are not expensive. They are considerably more costly than cloth or paper filters and may be more expensive than wire screen filters or ceramics.

But these filter elements are not intended for indiscriminate replacement of all other types. To get the greatest advantage from them they must be properly applied and designed for the job. Under these conditions the cost is quite moderate.

Other applications

There are a number of applications for filter materials where filtration is not the purpose.

Figure 3 illustrates a ground plate for a ship-to-shore radio. Here the high porosity of the material gives a large area of contact so that effective grounding is secured. This ground plate is about 2″ x 8″ x ¾″ and replaces a strip of copper 6″ x 10′. It is just as effective a ground as the long copper strip and has the added advantage of easy installation. Two bolts hold the ground to the hull and one of them may act as the electrical connection. There is no chance of this ground being ripped loose due to wave action as the long copper strip might be.

The burner shown in figure 4, is another use of filter materials. This particular design is used in a small alcohol stove. The stem acts as a wick and the flat surface the burner surface. The pore size regulates the rate of the wicking of the alcohol and the size of the many small jets of flame that cover the burner surface. Material of this sort has recently been used to replace the common cylindrical fabric wick in an ordinary kerosene stove. Wick cleaning, trimming and replacement are eliminated.

Another application of these materials is in the upper burner in ovens on gas stoves. Here a tube two or three inches wide and from seven to ten inches long is used. By control of the porosity of the filter material the flame characteristics are controlled. The great advantage here is in the uniform distribution of minute flames over the entire burner surface.

Figure 2a illustrates the use of porous materials as surge supressors ahead of gauges in hydraulic lines. This application has been noted above. In this application remember that the supressor must be in a clean fluid line so a filter should proceed it. This same general type of unit is widely used in the breather lines on gasoline tanks where it acts as a flame supressor.

In another application, filter elements are used as breathers or vents in automobile engine crank cases. Such a plug is shown in figure 2b.

In still other applications metallic filters act as flame supressors in the throat of loud speakers where the speaker is installed in an explosive atmosphere.

The frangible cones for shaped charges (see the conical part in figure 1) are actually filter material.

Two Men Burned by Flaming Oil Stream

2nd - Class Postage Paid at [redacted] Post Office

[redacted], 25, of [redacted] is in "very critical" condition at [redacted] hospital after receiving third degree burns over 70 per cent of his body in an industrial accident Monday at the [redacted] on [redacted].

A fellow employee, [redacted], also 25, of [redacted], is in "satisfactory" condition with burns of the body, face, arm, one leg and back, about 10 per cent of which are third degree burns. Dr. [redacted], phsician for both men, said yesterday.

[redacted], an employee in the casting department, was standing with his back to a hydraulic casting machine directing a fork lift which [redacted] was operating when a gasket on the machine broke.

A stream of oil, under 1,200 pounds pressure and ignited by the heat of the aluminum furnace, hit [redacted] 12 feet from the machine, standing only 10 square in the stream, sprayed over him, setting his clothes on fire. [redacted] was partially protected from the spray by a guard on the fork lift.

[redacted] and Ptl. [redacted], who responded to the call along with the First Aid Squad, said the stream of flaming oil acted just like a giant flame thrower.

[redacted] operator of the machine, shut it off immediately. [redacted] the foreman, threw [redacted] to the floor and started to rip his clothes off. Employees also threw sand on him in an effort to put out the flames.

Police said the operation of running the fork lift was usually done by one man, but [redacted], who had been laid off from another department several weeks ago, had just been rehired to learn the job of moving the melted aluminum to the machines. [redacted] was training [redacted].

The oil sprayed onto the windows on the west side of the building and even onto the ceiling from the terrific pressure. One unit of the automatic sprinkler system in the plant was activated and caused the alarm to be set off at headquarters.

[redacted] in his stunned condition, walked to the ambulance and again from the ambulance into the hospital. [redacted] was taken in the police car.

THE MAN DIED who was reported in critical condition. He would be alive and the other workman would not be burned if this die casting company had been using fire resistant hydraulic fluid.

We understand that since this fire a good fire resistant fluid has been installed in all of the die casting machines in this plant.

The plant had a sprinkler system installed and this satisfied the insurance company and the die casting company. Actually all a sprinkler system does is to spread the fire. It's worse than useless, it's dangerous.

We wonder if the few dollars which may have been saved by the company were adequate compensation for a man's life.

P. R. KALISCHER
Editor

TRIM DIES

. . . properly designed and built are necessary to a successful die casting operation.

Perhaps you have been looking for a source that specializes in designing and building trim dies.

We at **KEN DIE & TOOL** are privileged to be recognized by an ever increasing number of die casters as one of the leaders in this specialty field. Our engineering department and skilled die-makers pride themselves on their "trim die know-how".

As an additional service to die casters, we specialize in making:

- **SHOT SLEEVES**
- **PLUNGER TIPS (STEEL & COPPER)**
- **NOZZLES, ETC.**

Our modern plant and facilities are conveniently located in Des Plaines, adjacent to Chicago.

KEN • *Die and Tool*

1285 Golf Road
Des Plaines, Illinois
Phone: VAnderbilt 7-5458

Circle No. 92 on Reader Service Card

Die Casting In Tomorrow's Products

MAKE NO MISTAKE ABOUT IT—tomorrow the cost of manufacturing is going to be higher than it is today. Labor rates will go up and productivity per man-hour will go down. That's why more and more products will be die cast. Economy in manufacture, the most desirable configuration, and minimum acceptable weight will be the three controlling factors which will dictate the use of die castings. Let's look at each one.

ECONOMY

Put metal where you want it, not where it has to be machined away later as generally happens with sand castings, forgings, or machining from wrought stock. Thin walls, properly ribbed, give the strength needed without first casting in masses of metal which must be machined away. Accurately cast locating planes and points make machining on automatic setups fast and inexpensive. Good design eliminates many machining operations, especially milling machine work.

Fastening devices can be cast in or designed for the lowest possible assembly costs through the use of thread-cutting screws, speed-nuts, and threaded fasteners.

Surface finishing operations can be cut to the bone by specifying an as-cast surface which is ready to finish as received or with very little work to be done. Those are just a few of the economies you'll get by using die castings.

CONFIGURATION

There's no need to sacrifice the most desirable shape because of costly or impossible machining. Whether the shape is for aesthetic reasons or for functional requirements you can get it by die casting. And don't forget, the buying public is getting more particular. The products which the consumer buys must have eye-appeal. The day of the functionally good, but clumsy-appearing product has just about passed; it's never coming back. So in the future, look to die castings to get the shape you need and one your customers will buy.

WEIGHT

Maybe too much emphasis has been placed on weight reduction. Everyone thinks about the person who is going to use the product. Hence, to get light weight, the designers have sacrificed both strength and rigidity. In many cases they have gone too far and lost stability as well.

With the wide variety of metals which can be die cast it is possible for the designer to make an intelligent choice of the best strength-to-weight ratio. The product will stand up under the intended service, will have minimum weight, will take the finish desired, and ultimately be the lowest cost.

Remember that service calls are expensive and no customer wants his or her equipment out of service because some designer tried to save a pound through the use of plastics instead of metal. It's false economy.

Then don't forget shipping charges. A lightweight die casting can mean less expensive shipping containers and overall lower freight charges.

So in the future, look for more die castings in more and more products.

Your forecast for

GREATER SAVINGS on DIE CAST DIES

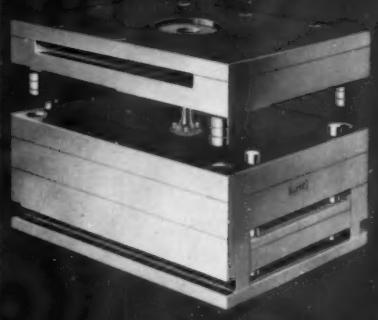
...should include

D-M-E STANDARDS

Custom-designed STANDARDS for DIE CASTING

STANDARD DIE CAST DIE ASSEMBLIES

32 Standard Sizes
Up to 23¾" x 35½"
Complete interchangeability

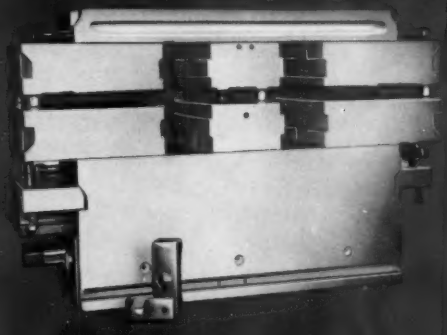


STANDARD Rack and Pinion EJECTOR BOXES

Patented Light-weight Design
15 Standard Sizes

STANDARD UNIT DIES

For Zinc and Aluminum Die Casting
2 Std. Sizes
(Pat. Pend'g)



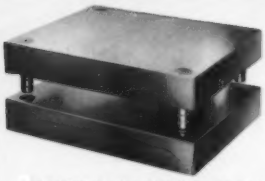
Water-cooled SPRUE SPREADERS

For Zinc Die Casting

Water-cooled SPRUE BUSHINGS

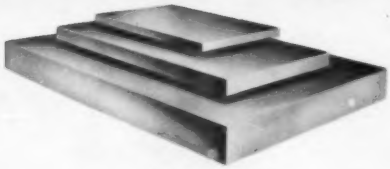
For Zinc Die Casting

D-M-E STANDARD COMPONENTS



CAVITY RETAINER SETS

Plate thickness ⅞" to 5⅞"—32 Std. Sizes



MOLD PLATES

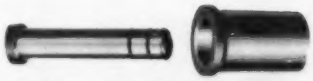
EJECTOR HOUSINGS

One-piece Construction

SPACER BLOCKS

Plain—Slotted—Angle

SUPPORT PILLARS—3 types



LEADER PINS and BUSHINGS

BRASS BAFFLES and ROD

CASCADE WATER JUNCTION

EJECTOR PINS—Hotform or Hotalloy

CORE PINS—3", 6" and 10" Lengths

EJECTOR SLEEVES—4", 6", 8" and 10" Lengths

MOLDMAKERS' TOOLS AND SUPPLIES

Ejector Pin COUNTERBORES

MACHINE REAMERS—Including .005" oversize

Brass FLEX-O-LAPS —⅛" to ¾" Diameter

TAPERED MILLING CUTTERS—½° to 7° Taper per side

HIGH SPEED END MILLS—Two and four flute

LONG DRILLS—For water lines

Leader Pin and Bushing COUNTERBORE

EXTRA LONG SCREWS—Up to 12" in stock

SOCKET HEAD STRIPPER BOLTS

¼" to ¾" Shoulder Diameter

DOWEL PINS

SET SCREWS

FLAT HEAD SCREWS

MOLD POLISHING SUPPLIES

ELECTRIC HAND GRINDERS

HI-SPEED AIR GRINDERS

CARBIDE CUTTERS

ABRASIVE MOUNTED POINTS

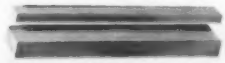
ABRASIVE STONES

DIAMOND COMPOUND and Applicator Guns

FELT POLISHING KITS

BRISTLE BRUSHES

MOLD POLISHING COMPOUND



WOOD POLISHING STICKS

RUST PREVENTIVE

ABRASIVE BENCH ROLLS

ABRASIVE POWDER

DME

In stock at your local D-M-E distributor

Circle No. 26 on Reader Service Card

Which Industries Buy Die Castings?

TRENDS FROM 1950-1960:

Practically all markets for die castings grew in the past ten years. With it came greater diversification. Some uses increased at about the same rate as the overall economy; others increased faster than the average. These latter are due not only to greater numbers of end products manufactured, but also a greater number of die castings per unit. Important trends can be noted in the tabulation below, based on shipments of die castings in all metals by contract die casters. No captive shipments are included in these tallies.

	ZINC					ALUM	
	1950		1960			1950	
END USE IN INDUSTRY GROUPS	% of	Estimated Pounds	% of	Estimated Pounds	%	% of	Estimated Pounds
Agriculture, Mining & Construction Equipment	0.9	3,000,000	1.1	4,600,000	53.3	1.2	1,700,000
Automotive (Motor Vehicles)	51.0	173,250,000	49.8	208,600,000	20.4	23.0	29,350,000
Other Transportation	2.0	7,000,000	1.2	5,000,000	-28.6	2.0	2,600,000
Industrial & Commercial Machinery and Tools	7.3	25,000,000	9.6	40,200,000	60.8	14.3	18,200,000
Electronic Devices & Communications Equipment	2.7	9,250,000	1.8	7,500,000	-18.9	1.2	1,600,000
Office Equipment & Business Machines	1.9	6,250,000	4.3	18,000,000	188.0	6.4	8,100,000
Plumbing & Heating and Builders Hardware	6.7	23,000,000	7.8	32,650,000	41.9	4.0	5,100,000
Photographic, Optical Recording Devices, etc.	2.6	8,750,000	2.9	12,150,000	38.9	11.6	14,700,000
Timing & Time Operated Devices; Clocks	0.9	3,000,000	1.9	7,950,000	165.0	1.8	2,300,000
Home Appliances	20.9	71,000,000	18.1	76,100,000	7.2	30.9	39,350,000
Toys, Sporting Goods, Personal Goods & Jewelry	2.9	9,750,000	1.2	5,000,000	-48.7	1.8	2,200,000
National Defense	0.2	750,000	0.3	1,250,000	66.7	1.8	2,300,000
TOTALS BY METALS	100.0	340,000,000	100.0	419,000,000	23.2	100.0	127,500,000

HOME APPLIANCES *continued to be the second largest use for die castings.*

BUSINESS MACHINES *more than doubled their use of die castings in all alloys.*

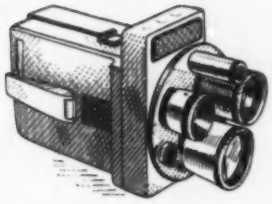
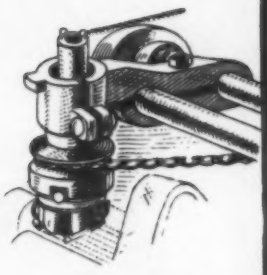


PHOTO EQUIPMENT *makes use of precision and good finishability of die cast metals.*

HARDWARE ITEMS *that are die cast include plumbing, heating, building and cabinet fittings.*



INDUSTRIAL MACHINERY, *third biggest die casting user, shows gains in all alloys.*

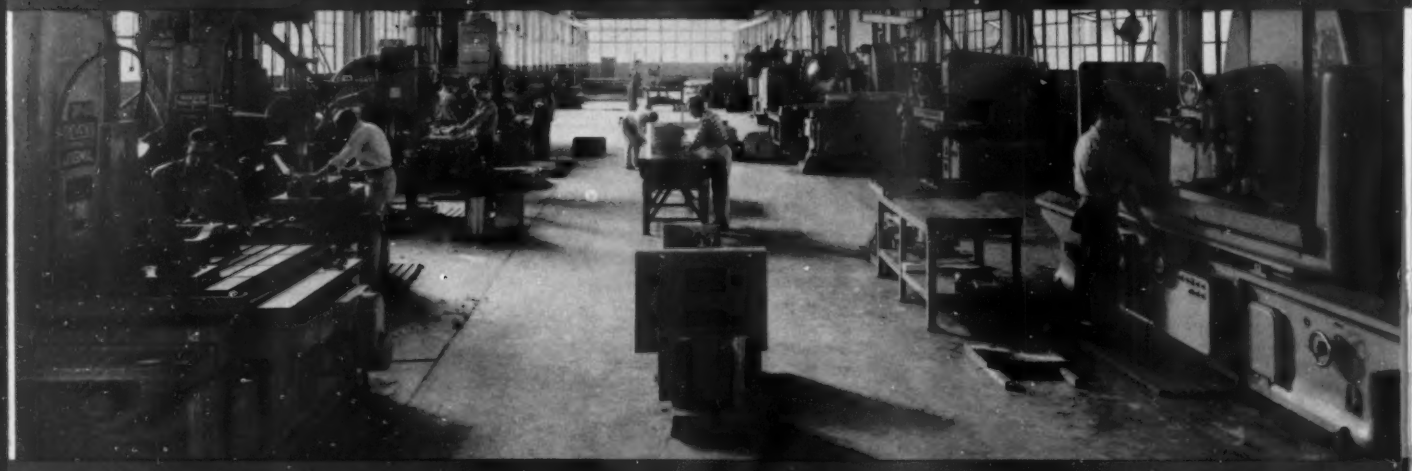
UMINUM

MAGNESIUM

BRASS

	1960			1950		1960			1956		1960		
	% of total	Estimated Pounds	% change	% of total	Estimated Pounds	% of total	Estimated Pounds	% change	% of total	Estimated Pounds	% of total	Estimated Pounds	% change
0	3.6	7,800,000	358.8	0.6	7,750	—	——	—	1.0	45,000	0.6	45,000	0.0
0	34.7	75,400,000	156.9	20.2	232,300	10.6	460,000	98.0	5.8	260,000	9.0	650,000	150.0
0	1.3	2,800,000	7.7	0.8	9,600	0.3	12,500	30.2	0.1	5,000	0.3	25,000	400.0
0	14.0	30,500,000	67.6	15.1	172,650	51.7	2,250,000	1203.2	18.3	825,000	15.3	1,100,000	33.3
0	1.4	3,000,000	87.5	2.1	23,600	4.1	180,000	662.7	—	—	—	——	—
0	7.8	16,900,000	108.6	15.0	171,700	7.0	300,000	74.7	0.6	30,000	1.3	95,000	216.6
0	5.0	10,850,000	112.7	–	–	—	——	—	55.1	2,475,000	63.9	4,600,000	85.9
0	8.1	17,500,000	19.0	7.0	80,200	9.7	424,000	428.7	0.6	30,000	2.4	170,000	466.7
0	1.2	2,600,000	13.0	–	–	0.4	18,500	—	1.1	55,000	0.6	45,000	-18.1
0	17.3	37,500,000	4.7	24.3	278,050	5.5	240,000	-13.7	0.3	15,000	1.7	120,000	700.0
0	3.8	8,250,000	275.0	1.2	13,650	0.9	40,000	192.6	0.8	35,000	2.8	20,000	-42.9
0	1.8	3,900,000	69.6	13.7	156,500	9.8	425,000	171.6	16.3	725,000	2.1	150,000	-79.3
0	100.0	217,000,000	70.2	100.0	1,146,000	100.0	4,350,000	279.6	100.0	4,500,000	100.0	7,200,000	60.0

SOURCE: THE AMERICAN DIE CASTING INSTITUTE



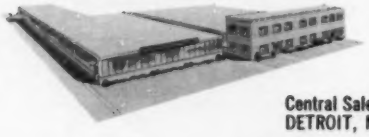
D-M-E SPECIAL MACHINING SERVICE

Complete facilities for Jig Boring, Pocket Milling, Water Lines and Special Plates

LET D-M-E QUOTE ON YOUR NEXT SPECIAL MOLD...AND SAVE

QUALITY

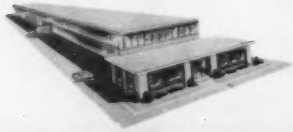
The finest manufacturing facilities to give you the best quality



Central Sales & Mfr'g.
DETROIT, MICHIGAN

Eastern Mfr'g. HILLSIDE, N. J.

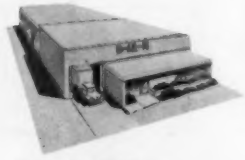
Ejector Pin & Parts Div.
CHARLEVOIX, MICH.



Special Mold Div.
MT. CLEMENS, MICH.

SERVICE

SEVEN Branch Offices to give you faster service. Complete stocks at



Detroit, Michigan
Hillside, New Jersey
Chicago, Illinois
Cleveland, Ohio
Dayton, Ohio
Los Angeles, Calif.
Toronto, Ont., Canada

ECONOMY

D-M-E Standard interchangeability saves you time and money on . . .

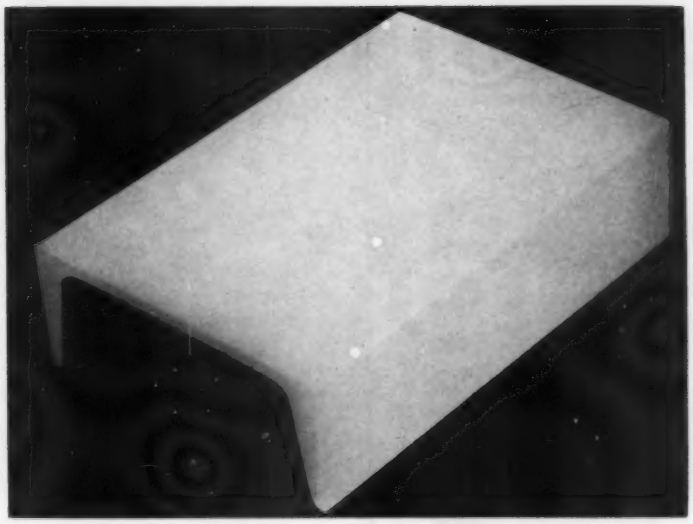
STANDARD MOLD BASES

SPECIAL MOLD BASE WORK

EJECTOR PINS

MOLD PARTS and SUPPLIES

D-M-E CORPORATION

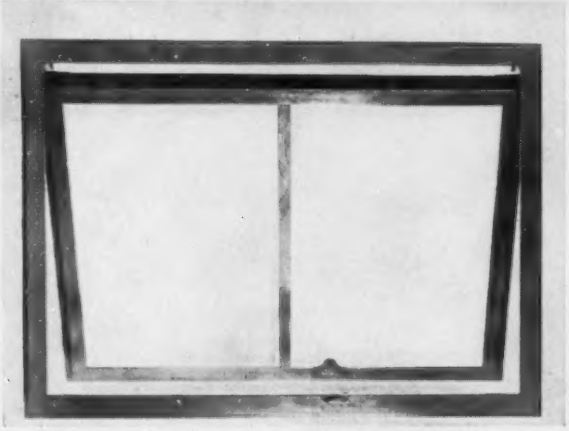


FABRICATED STRUCTURAL STEEL coated with the low-temperature frit porcelain enamel.

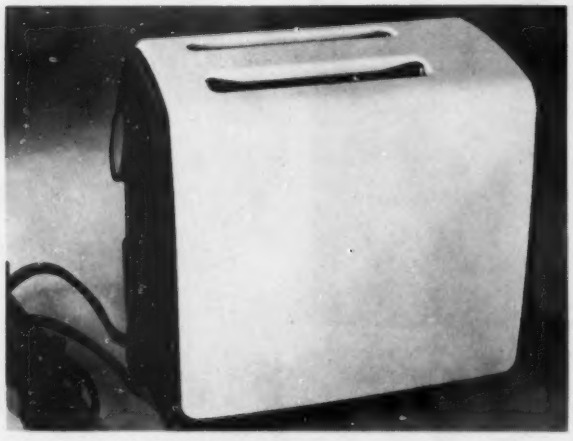
NEW PORCELAIN ENAMEL FOR STEEL EXTRUSIONS

NOW YOU CAN HAVE porcelain enamel coatings on steel extrusions with fewer design and application problems. New extra-low-temperature frits that fire at 1000° to 1100° F give excellent coverage of corners and sharp angles. Lower firing temperatures mean less heat distortion. And less distortion means that now only one side of a part needs to be coated. This can be a special benefit for hollow items such as sash and window frames. In designing a part to be coated with the new enamel, the only special consideration is the added thickness of the coating.

The tensile strength of steel at 1000° to 1100°F is much higher than at the conventional enameling temperatures. Therefore, there is less tendency for the steel to sag during firing. Because the firing temperature of the new frits is below the transforma-



EXTRUDED STEEL SASH and window frames are coated on only one side with the low-temperature frits, yet do not distort during firing. Excellent coverage is obtained on sharp corners and radiuses.



NO SPECIAL CONSIDERATIONS were necessary in designing the exterior of this toaster to be finished with the new porcelain enamel coating. Formerly, the surface was organic coated.

GENERAL CHARACTERISTICS OF EXTRA-LOW-TEMPERATURE PORCELAIN ENAMELS

- Firing Temperature—1000° to 1100°F.
- Warpage—None; almost no limit on the shapes that can be coated.
- Coverage—Excellent, even on sharp edges and radii.
- Adherence—Thin coating and high adherence make it possible to bend enameled sheets without chipping.
- Surface Finish—Similar to organic coatings.
- Gloss—Better control than with conventional porcelain enamels.
- Reflectance—76% in white.
- Acid Resistance—A to AA rating (PEI citric acid test).
- Abrasion Resistance—Harder than aluminum porcelain enamels; softer than conventional porcelain enamels for steel.

tion temperature of steel, there is no objectionable change from ferrite to austenite.

The new frits can be applied in two to five mil coats, compared to the five to twelve mils formerly required. Thinner coats mean less stress in the coating during firing.

Properties

The new coatings share most of the properties of high temperature coatings: high abrasion, scratch and chemical resistance, and high hardness. However, the new frits do not lay down as well and aren't as smooth. They look very much like organic finishes.

In white and most other colors they get a P.E.I. (Porcelain Enamel Institute) citric acid spot test rating of A to AA. Certain strong colors, particularly the cadmium-selenium reds and oranges, have lower ratings.

Weather resistance is expected to be good because of the high acid resistance, but there is little data on this yet. So far, no deterioration has been observed in installations after several years' exposure.

Greatest application of the new enamel is likely for parts with complicated shapes or thin walls. The new frits may compete strongly with organic coatings.

Processing

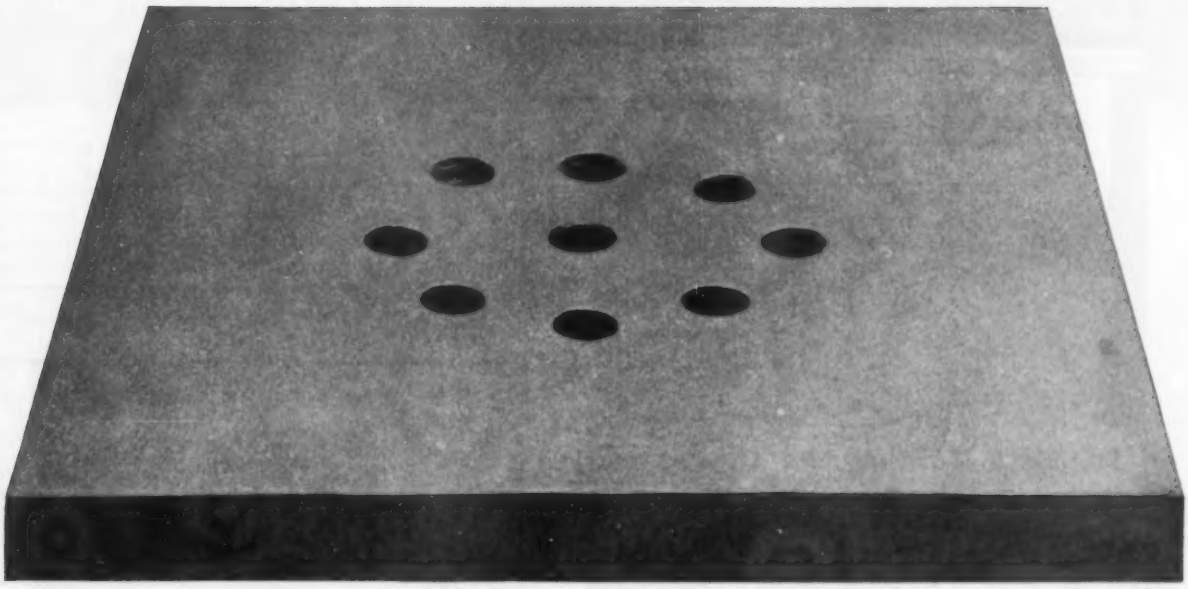
Extra-low-temperature frits do not require special enameling-grade steels. Cold-rolled steel is good enough. But the new frits require clean steel and close control of firing temperatures. Shortcuts, particularly in the cleaning, will mean trouble, especially when using non-premium steels. This is the recommended metal preparation schedule:

1. Cleaner bath: boil for twenty minutes in a proprietary bath (Oakite, Wynadotte, or equivalent).
2. Water rinse, room temperature.
3. Acid bath: 6% to 8% sulfuric acid, 150°F, 10 minutes.
4. Nickel dip: 0.06 to 0.08 gm./sq. ft.
5. Water rinse, room temperature.
6. Neutralize: ½ to ¾ normal strength. Dilute neutralizer will minimize blisters and similar defects caused by residual salt on the steel surface.
7. Dry.

Application

Recommended method is spraying. Due to the low firing temperature, using clay and electrolyte formulations in the slip is bad for dipping. The base

BLAST!



Remove burrs faster at lower cost...with Blastite® Ever think of removing burrs by pressure blasting with sharp abrasive grain? It's worth investigating . . . this steel plate was deburred with Carborundum Blastite No. 100 in just a few seconds with standard equipment. And note: none of the burrs were merely turned over—every hole is clean-as-a-whistle. A radius has been added and the surface cleaned.

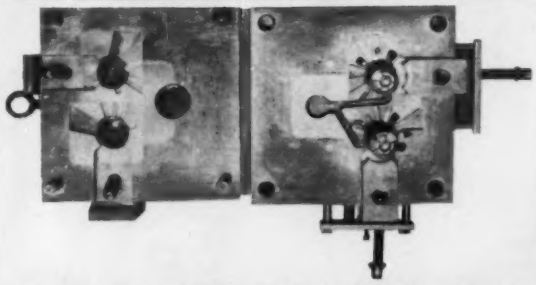
Pressure blasting may prove to be *your* most efficient method—not only for many deburring jobs—but also for removing surface deposits, finishing hard-to-reach areas, stress relieving and forming decorative finishes. You can quickly investigate the benefits of pressure blasting for any finishing operation—simply call your Carborundum distributor or district office. A fully equipped abrasive finishing methods laboratory and sample processing facility is at your service.

CARBORUNDUM

Circle No. **76** on Reader Service Card

Electro Minerals Division, Niagara Falls, New York

Circle No. 24 on Reader Service Card



PRECISION DIE MAKING

A new and modern well-equipped plant that was designed and built from the foundation up to manufacture plastic molds and die castings dies exclusively, is ready to go to work for you. Damen offers you complete engineering and manufacturing facilities to build your plastic molds and die casting dies. Latest machining methods including electrical discharge and acid etching. All requests for quotations get prompt and immediate attention.

- KELLERING
- ENGRAVING
- JIG BORING

Send for up-to-date brochure.

DAMEN TOOL & Engineering Co. Inc.
4621-27 N. Olcott Ave.
Chicago 31, Illinois
Phone: UNderhill 7-8111

FOR CLEANER ZINC AND ALUMINUM CASTINGS

FISKE'S F-456 Fluid Die Compound

A fluid product for spraying in its natural state—less frequent applications permits greater production —keeps dies clean with no build-up—improves surface finish—prevents sticking and soldering—minimizes carbon formation—reduces fumes and smoke.

Send for particulars. Write today.

FISKE'S

Since 1870

METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.
129D Lockwood Street, Newark 5, N. J.
Plants: Newark 5, N. J. and Toledo 5, Ohio

Circle No. 32 on Reader Service Card

coat and finish coat slips have good suspension, but poor set. Proper spraying of a slip of the correct consistency produces the desired surface texture. This overcomes the fact that the coats do not smooth out or lay down during firing.

Firing

Low-temperature firing requires forced convection heating for high production. This demands more complicated furnaces. But the lower firing temperatures should make possible these furnace savings:

- Less costly structural design.
- Lower maintenance costs.
- Less fuel consumption.

Conventional furnaces are not suitable for firing the new frits because they rely on radiation for most of their heating power. They are designed to operate at 1400° to 1500°F. To fire the new frits they would have to operate at lower temperatures. This would be inefficient and make the firing time too long.

COMPOSITION OF THREE TYPICAL EXTRA-LOW-TEMPERATURE PORCELAIN ENAMELS

(percent by weight)

	I	II	III
Na_2O	11.4	10.7	9.2
K_2O	2.3	2.2	1.8
Li_2O	2.1	2.0	1.8
B_2O_3	6.0	6.5	9.2
SiO_2	26.6	24.9	23.0
F_2	—	—	4.6
TiO_2	2.0	1.8	6.4
PbO	38.5	36.0	32.1
MgO	6.2	3.7	6.4
CaO	1.1	0.7	—
BaO	2.9	11.5	4.6
Sb_2O_3	—	—	0.9
	100.0	100.0	100.0

Shelf life

Shelf life is comparatively short. The reason is probably because the new frits must be ground very finely to mature evenly at the low firing temperature. The base coats work well after as much as three weeks' aging at room temperature. Cover coats should be used within one week.

Don't over-grind — it shortens shelf life. Troubles to be expected from aging are tearing, crawling, and rough, gassy texture.

Material for this article was contributed by the Lead Industries Association.

SHOCK TREATMENT!

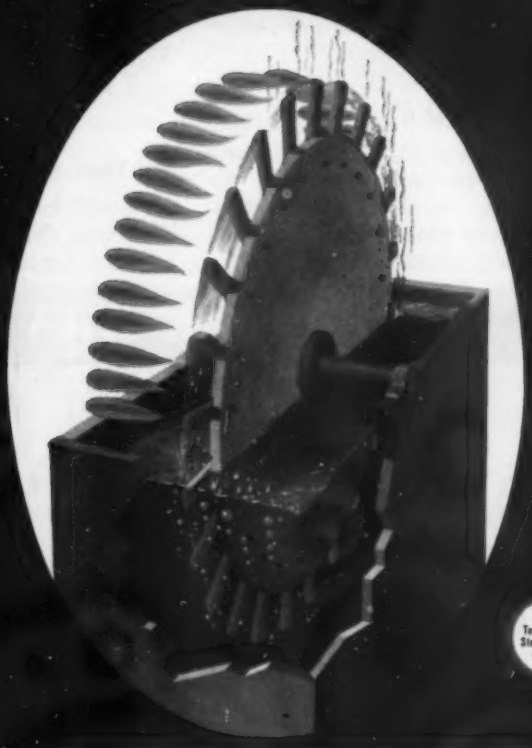
VACUUM-DEGASSED

THERMOLD® AV

DIE CASTING DIE STEEL

SHRUGS OFF THERMAL SHOCK

IN HEAT CHECKING TEST



Test samples heated to 1200° F. in this revolving fixture and repeatedly quenched in 70° F. water

•

A full cycle every 50 seconds

Here's proof of vacuum-degassed Thermold AV's improved resistance to thermal shock. Compare the results between vacuum-degassed and regular electric arc air melted samples shown at right. Note the superior resistance to heat checking evidenced in the vacuum-degassed test pieces. It's easy to see why Universal-Cyclops Thermold AV now assures you of longer die life, longer runs, finer finish . . . *more profitable production.*

Vacuum-degassed Thermold AV is a cleaner steel. Greater internal soundness (Reflectoscope proved), higher polishing quality, and greater resistance to fatigue and heat failure have made it today's ultimate in die casting die steels.

Call your nearest Universal-Cyclops Service Center for more information or for fast, off-the-shelf delivery. It's available in a complete range of sizes . . . including giant 4-ton blocks.

UNIVERSAL CYCLOPS

UC STEEL

STEEL CORPORATION

EXECUTIVE OFFICES; BRIDGEVILLE, PA.

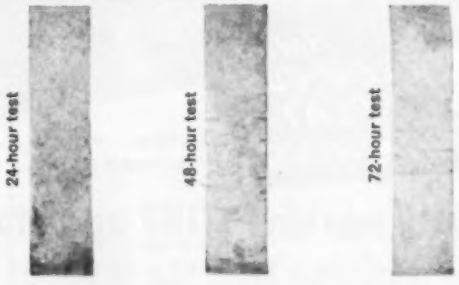
Circle No. 71 on Reader Service Card

EXAMINE THESE TEST SAMPLES!

All samples shown were made from the same heat, part of which was vacuum-degassed, and the balance cast in normal fashion in air.

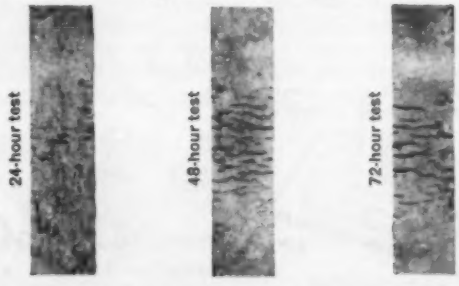
✓ **VACUUM-DEGASSED ARC MELTED SAMPLES**

Note that the samples were hardly affected by the thermal shock test.



✓ **NORMAL ARC MELTED SAMPLES**

Note the typical heat checked surface of these samples, subjected to the same test.



ORIGINAL, UNRETOUCHED LABORATORY PHOTOGRAPHS

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

news of industry & associations

Continued from page 29

Now it's D-M-E

After having been called "D-M-E" for twenty years by its customers, suppliers and employees, Detroit Mold Engineering Co. has finally decided to say "uncle". The firm officially became D-M-E-Corporation as of July 1.

Since its founding in 1942, the company has become national and international in scope, with facilities in Hillside, N.J., Chicago, Cleveland, Dayton, Los Angeles, Youngwood, Pa., and Toronto as well as its main plant in Detroit.

Voi-Shan acquires D-M-E

In addition to the name change (see item above) the D-M-E Corporation has announced that it has been acquired by Voi-Shan Industries, Inc. of Los Angeles.

Company officials say that D-M-E will continue to operate all of its facilities as a subsidiary of VSI, with no change in sales policy, management, or personnel.

Voi-Shan Industries is a supplier of precision aircraft and missile fasteners, magnetic tape recorder heads, and one-piece seamless metal door knobs.

D-M-E makes standard mold bases and moldmakers supplies.

Trim Alloys building new plant

Trim Alloys, Inc., has broken ground for a new plant in Randolph, Mass. which will have 60,000 square feet of offices and factory space.

It is being built on a ten acre site of land close to town which is serviced by an industrial spur. Completion is expected by this fall.

The firm is equipped to make all its own dies, fabrication tooling, and machinery parts. It is also equipped for bending, punching, notching, forming, polishing, anodizing and welding of aluminum.

Carborundum expands Globar Electronics plant

Carborundum Co. has announced a 1½ million dollars modernization and expansion of its Globar Electronics plant at Niagara Falls.

General Clinton F. Robinson, president, stated that this project is designed to provide increased production capacity and improved precision control of manufacturing processes, and to improve facilities for the Globar technical department and also for the manufacture of new electronic product lines.

The Globar Electronics plant is a branch of Carborundum's Refractories Division.

Engineering papers published quarterly

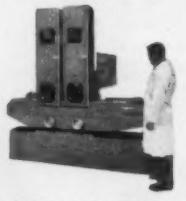
A new publication, the ASM Metals Engineering Quarterly, will include outstanding presentations made at the Metals Engineering Program Committee technical sessions and the several American

ONE machine–ONE operator–ONE pass

Let's face facts—costs are high and will go higher. You can, however, *REDUCE* flat finishing costs with a Hammond Flat Finisher. Grinding, deburring, and finishing of flat surfaces of plates, printed circuits, bars, stampings, extrusions, etc., can be done uniformly on a high production basis with *ONE* machine ... *ONE* operator ... *ONE* pass.

Hammond Flat Finishers have the latest features: *automatic* belt tracking and oscillation, *automatic* air tensioning for abrasive belts and conveyor belt, *variable* speed conveyor, *ammeter* on each head, and other features which contribute to maximum production at lowest possible cost.

1 TO 6 HEADS
6" TO 12" WIDE



Available in 6", 8", and 12" widths

Send us one finished and a few rough samples so our engineers can analyze your finishing requirements. No obligation.

Hammond Machinery Builders INC.
1642 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

Circle No. 77 on Reader Service Card

Society for Metals chapter-sponsored regional conferences held throughout the United States. Many papers will be published within weeks of actual presentation. The new quarterly publication will answer a long-standing need for publication of the papers in ready-reference form.

Luckey reduction plant bought

Aluminum and Magnesium, Inc. has bought the government owned magnesium reduction plant at Luckey, Ohio. Purpose is to recover magnesium from approximately 9-million pounds of government surplus bomb bodies.

A subsidiary has been formed, Luckey Industries, Inc. Officials are: J. G. G. Frost, chairman of the board; D. H. Warner, president; J. J. Williams, vice president; A. J. Vaith, secretary; and A. H. Fisher, treasurer. All are officers of the parent company.

Fulton purchases Dollin

Fulton Industries, Inc., of Atlanta, has announced the acquisition of the business and operating assets of the Dollin Corp., producer of aluminum and zinc die castings. The firm will operate as a division of Precision Castings Co., one of of Fulton's six operating divisions. The acquisition is Fulton's third within the past month. It had previously acquired 33 acres of land adjacent to Chicago's O'Hare International Airport, and also an 80 per cent interest in the Elmes & King Manufacturing Co.

Picker announces new industrial testing division

Picker X-ray Corporation has formed a new division to design and produce individualized nondestructive testing systems for industry. The new division will be called Picker Special Products.

Donald T. Green, chief industrial applications engineer for Picker, has been named manager of the Special Products Division, which will be located in Cleveland where the company has its research and manufacturing facilities.

Consolidated Astronautics absorbs United International

Consolidated Astronautics, Inc., has purchased all the rights to the processes and equipment for the manufacture of air-stable titanium metal powder from United International Research, Inc., of Newark, N. J.

Consolidated plans to market the powder and various derivations on an international basis.

Establish sintered product div.

Russell, Burdsall & Ward Bolt and Nut Company has established a Sintered Products Division. Typical parts to be produced from powder metals by RB&W include standard nuts, special nuts and shapes with tapped holes, sleeves, spacers, inserts, disc, gears, rollers, electrical connectors, mechanisms and bushings.

more Industry News on next page

NEW FROM SYNTRON

VIBRATORY BARREL FINISHING MACHINES

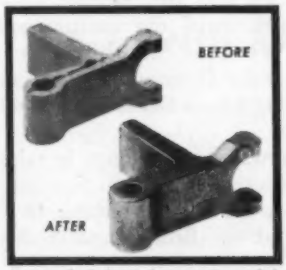
NEW HIGH SPEED, COMPACT ELECTROMAGNETIC UNITS!

LOADING
Fast, easy! Inspect parts while work cycle continues.

ADJUSTING VIBRATION
One control to vary amplitude.

PREPARING FOR EMPTYING
Connect hose; flush out compound.

SYNTRON INTRODUCES AN ENTIRELY NEW CONCEPT IN THE ART OF PARTS FINISHING!



Unretouched photos demonstrate results!

The secret—powerful Syntron electromagnetic vibratory drive! 3600 vibrations per minute. Parts and media constantly agitated by high speed, controlled directional vibrations. Hard-to-get-at places and shielded areas are worked more thoroughly. Handling minimized!

61-BF-3

SYNTRON COMPANY
254 Lexington Avenue • Homer City, Pa.

"Other Syntron equipment of proven dependable quality."

Parts Feeders

Transfer & Storage Parts Feeders

Rectifier Power Units

Circle No. 79 on Reader Service Card

The Abbot asks you: What's right for your product... FINISH ...or CUT?

WHEN METAL PRODUCTS or parts need a polished, mirror-like, glass-hard *finish*, steel burnishing should be used . . . not synthetic abrasives, which have comparative application superiority only when *cutting* is what's wanted.

The high-quality steel shapes shown above on the top are products of the Abbott Ball Company, since 1909 the world's leading producer of steel finishing materials. Each different shape is designed for a special job.

SEND A SAMPLE of your product or part to us. Without charge, we'll conduct a thorough test and analysis on it, and return useful recommendations to you promptly.

Examining some samples after their test-run in the Abbott lab.

Write for copy of Bulletin AP-1

ABBOT the Leader since 1909

THE ABBOTT BALL COMPANY

7 RAILROAD AVE. • HARTFORD 10, CONN.

Circle No. 74 on Reader Service Card

news of industry & associations

Continued from page 97

Rogers Industries offers bonus prizes in design contest

Rogers Industries, Inc. of Detroit has announced that it will provide bonus prizes to winners in the Kaiser Aluminum extrusions contest. The design competition is being sponsored by Kaiser Aluminum & Chemical Corporation in conjunction with the nation's independent extruders.

Rogers Industries will add a $500 bonus to the $2500 first place award, $250 to the $1000 second place award, and $50 bonuses to each of the five $100 awards.

The design competition is open to all engineers and designers. Entries may show existing, potential or "dream" designs in extruded aluminum.

Additional information on the contest, including entry blanks, is available from any independent aluminum extruder.

Hydraulic Press changes name

The Hydraulic Press Manufacturing Co., acquired by Koehring Co. in 1956, has changed its name to H-P-M- Division, Koehring Co. Previously, this Mt. Gilead, Ohio manufacturer of die casting and metal working machines was known as the Hydraulic Press Manufacturing Co., a Division of Koehring Co.

There will be no change in sales, administrative, or manufacturing functions. These will continue to be located at the firm's plant in Mt. Gilead.

Michigan Company buys Allied Research & Engineering

Michigan Chrome and Chemical Co. of Detroit has purchased Allied Research and Engineering Div. of Lytle Corp. The organization will now be known as Allied Research and Engineering Co. Allied was established about ten years ago as a

COLOR FILL • CODE MARK • IMPRINT your products, parts, caps, containers, etc. with the—

ACROPRINTER®

Tedious hand filling, messy spraying and sloppy applications of color . . . are eliminated when you use the ACROPRINTER®. We make a flexible die of ACROPRENE® to exactly match the cavity, depression and contour of your part or product, then set it in the ACROPRINTER® No. 301 or No. 401A . . . making your color filling operation a high production mechanical one that applies printing ink or enamel precisely and attractively.
Die-Cast, stamped, embossed, molded, cast and engraved parts are accurately color filled with lettering and design.

®ACROPRINTER Model No. 401A

Model No. 301 is a hand operated machine adjustable for utmost perfection. Model No. 401A is the air-operated machine with that same precise touch and higher speed.

For FILLING or PRINTING, send a sketch, sample part or description with dimensions. Acromark Engineers will give you the full answer promptly, with illustrating data.

The ACROMARK Company

426 Merrell St., Elizabeth 4, N. J.

"The Original Marking Specialists"

Circle No. 75 on Reader Service Card

custom electroforming Division of Allied Record Manufacturing Co.

New die casting firm founded

Dycast, Inc., a new die casting firm, has been founded by William D. Johnson. Johnson has resigned as assistant manager of manufacturing for Bell & Howell. The new firm is located in Skokie, Illinois.

New method for protecting buffed or anodized aluminum

Extruded Alloys, Inc. of Bedford, Indiana has introduced a new and practical method for protecting buffed or anodized aluminum extrusions used in the decorative metal trim industry.

Called "concooning," the process involves the automatic spray coating of extrusion surfaces with a plastic coat which can be stripped.

The company has completed the installation of an automatic spray coat line which applies a thin plastic coating over brightly buffed or anodized extrusion surfaces. The clear film coating protects the extrusion finish from damage through handling or other in-plant operations. The coating can be easily stripped by hand after the extrusion has been assembled on the finished product.

The baked-on coating may be applied to the entire extrusion surface including areas of complicated contour design. Abrasion tests indicate that adequate surface protection continues under both hot and cold temperature levels as well as extremely humid conditions. The coating is suitable for most forming operations, withstanding, for example, a two-inch radius bend without rupture.

Decorative extrusion users paying the premium for buffed or anodized finishes cannot tolerate surface scratches, abrasion defects, or other handling and traffic marks. Paper interleaved packages or boxes that protect the surfaces in transit do not afford the continued protection of handling and fabricating in the customer's plant.

Circle No. 97 on Reader Service Card

POWDER CONDITIONING AND PROCESSING

METALLIC AND NON-METALLIC POWDERS GROUND TO YOUR SPECIFICATIONS

- IRON POWDER
- FERRO PHOSPHOROUS
- FERRITES
- MILL SCALE
- COPPER
- TUNGSTEN
- COBALT
- NON-METALLICS
- SOLID CHEMICALS

SCREENING AND PARTICLE SIZE CLASSIFICATION

OPEN TIME AVAILABLE

MICRO METALS CORPORATION

99 President St. Passaic, N. J.
Dept. No. 3A
Member Metal Powder Ind. Fed.

Increase your profits with DFC crucibles & funnels

Since 1876, DFC has furnished crucibles, clay goods, and accessory materials which have set *standards of quality the world over*. More recently the unanimous acceptance and wide use of DFC transfer crucibles and funnels by the precision casting industry, is high testimony to their economy and dependability.

For precision casting...lost wax, investment and permanent mold. Transferring, pouring, spouting... there is a DFC crucible or funnel to meet your exact needs.

If you have a special crucible problem, let us work on it for you.

Denver Fire Clay Company

DENVER • SALT LAKE CITY • NEW YORK

The DENVER FIRE CLAY COMPANY DFO-5
3037 Blake Street, Denver 17, Colorado

Please send me further information on your full line of crucibles.

Name.....

Company.....

Address.....

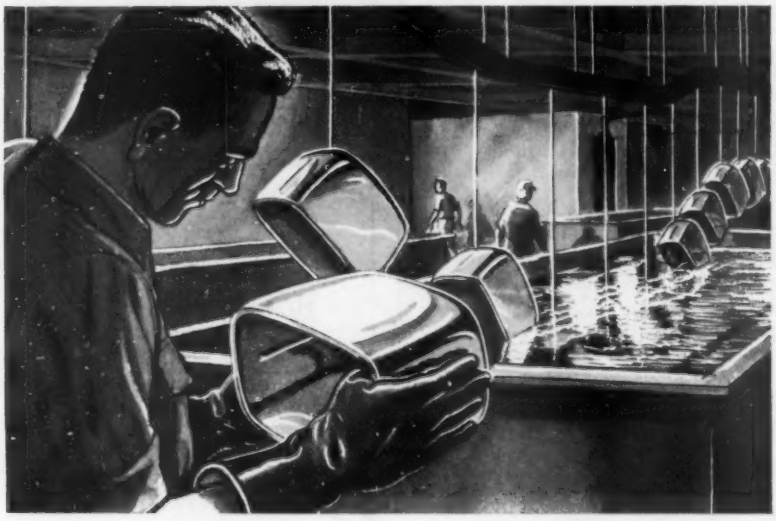
City and State.....

Circle No. 25 on Reader Service Card

For extra aids in cutting plating rejects . . .

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



Stop spots, add sparkle to plated parts with Oakite RINSITE® in final rinse

Just a little Oakite Rinsite in the final rinse after plating cuts rejects due to water spotting and staining. How? Rinsite "thins out" the rinse water, makes it drain more quickly, more completely.

While it leaves no drops to cause stains or tarnish . . . it *does* leave a thin, non-oily, invisible film that not only gives plated parts extra sparkle, but also protects against indoor rust.

Rinsite does a remarkable job in cold, hard rinse water. If you do tumbling operations, add Rinsite to the rinse and see how metal parts retain their newly-achieved gleam.

This liquid rinsing aid is just one of a line of Oakite materials to help avoid plating rejects. There are hard-working pre-cleaners . . . precision electro-cleaners for various metals. If you're interested in *results*, ask Oakite. Send today for Bulletin F-9822. Oakite Products, Inc., 34G Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

Circle No. 78 on Reader Service Card

promotions & changes

Continued from page 27

Reese Metal Products Corp.—*Donald B. MacKay* has become sales manager in charge of national sales.

The United States Graphite Co.—*John Klonowski* has been appointed sales and application engineer. He will service companies located in Connecticut and Eastern New York state.

Conforming Matrix Corp.—*Charles E. Laitsch* has been appointed representative for Western and Northern Michigan.

Ajax Magnethermic Corp.—*Charles C. Hanson* has been promoted to vice president and general manager Trenton Division, in charge of the Induction Melting Equipment Division. *James K. McLaughlin* has moved from assistant division manager to vice president in charge of the Youngstown Division. *Clifford Amend* has been appointed as metallurgist.

Foseco, Inc.—*Jack Parmenter* has been appointed technical sales representative in the Greater Chicago area.

Climax Molybdenum Co.—*John W. Goth* has been appointed manager of foundry sales.

Inductotherm Limemelt Corp. — *G. F. Kolle* has been named assistant general manager and treasurer.

General Motors, Central Foundry Division—*Carl A. Koerner* has been appointed divisional works manager. *Charles E. Drury* has been named divisional director of sales and engineering. *Thomas R. Wiltse* has been appointed divisional director of reliability succeeding Mr. Drury. *Thomas E. Smith* has been appointed plant manager of the Defiance, Ohio plant succeeding Mr. Wiltse. *Dale W. Wonus* has been appointed plant manager of the Danville, Ill., plant succeeding Mr. Smith.

Harbison-Walker Refractories Co.—*John H. Owen*, a Chicago district sales manager, has been named to the Board of Directors of Harper-Wyman Co.

Pennsalt Chemicals Corp.—*Linwood T. Geiger* has been made plant manager at Delaware, Ohio.

Howe Precision Products Co., a division of **Howe Sound Co.**—*Arthur B. Allison* has been named president.

The Metallurgical Society of AIME—*Richard C. Cole*, executive vice president and general manager of the White Pine Copper Co., has been made head of the Extractive Metallurgy Division. *J. Harry Jackson* of Columbus, Ohio, has been made head of the Institute of Metals Division, and *Dr. Gerhard Derge* of Pittsburgh, the Iron and Steel Division.

PMM

useful literature, catalogs, manuals *qualified readers may obtain*

any of these technical publications by circling the numbers on the reader service cards.

PROCESSES

145 *Permanent Mold Casting*—AMERICAN SMELTING & REFINING CO.—Brochure describes a treatment for ingots that produces pressure-tight permanent mold castings.

146 *Powdered Metal Parts*—BROCKWAY PRESSED METALS, INC.—Bulletin lists technical data and design suggestions for powder metallurgy components.

147 *Investment Castings*—HUMPHREY CASTINGS, INC. —34-page facilities brochure describes the investment casting process and shows some of its applications.

148 *Castings*—DODGE STEEL CO.—Technical bulletin lists standard designations and chemical composition ranges for heat and corrosion resistance castings.

149 *Impact Extrusions*—CLIFF MANUFACTURING CO.— 8-page PMM reprint tells how to design and use aluminum impact extrusions.

150 *Investment Castings*—KOLCAST INDUSTRIES DIV.— 28-page brochure describes facilities and procedures for producing investment castings with aerospace levels of reliability.

151 *Extrusions*—NUCLEAR METALS, INC.—Information bulletin on extruding difficult-to-make or custom parts not lending themselves to normal extruding practice.

MATERIALS & EQUIPMENT

154 *Induction Furnaces*—HEVI-DUTY ELECTRIC CO.— 12-page bulletin lists information on Hevi-Duty-Tagliaferri induction melting and receiving furnaces.

155 *Brass & Bronze Alloys*—AMERICAN SMELTING & REFINING CO.—56-page technical booklet on brass and bronze casting alloys, lists applications, properties, and compositions.

156 *Tool Steel*—BETHLEHEM STEEL CO.—Technical booklet on a low-carbon, high-chrome grade tool steel which resists heat-checking during high temperature service.

157 *Goosenecks*—DODGE STEEL CO.—Data sheet describes custom-made, special alloy steel goosenecks for die casting machines.

158 *Technical Motion Pictures*—ALLEGHENY LUDLUM STEEL CORP.—Booklet lists technical films available without charge to interested groups.

159 *Ceramic Tooling*—VASCOLOY-RAMET CORP.—Technical bulletins describe field-proven applications of Ceramic VR-97 cutting tool material, list machining advantages, new applications, tell where, when, and how to use the material.

161 *Nickel Powders*—SHERRITT GORDON MINES LTD.— Technical data and price list for high purity, closely screened, commercially available, nickel powders.

162 *Tool Steels*—BETHLEHEM STEEL CO.—14-page booklet lists properties, applications, and ordering instructions for a complete line of tool steels.

163 *Casting Alloys*—AMERICAN SMELTING & REFINING CO.—65-page booklet lists properties, metallurgical, and process information for aluminum casting alloys, includes commercial, ASTM, AMS, federal, and military designations.

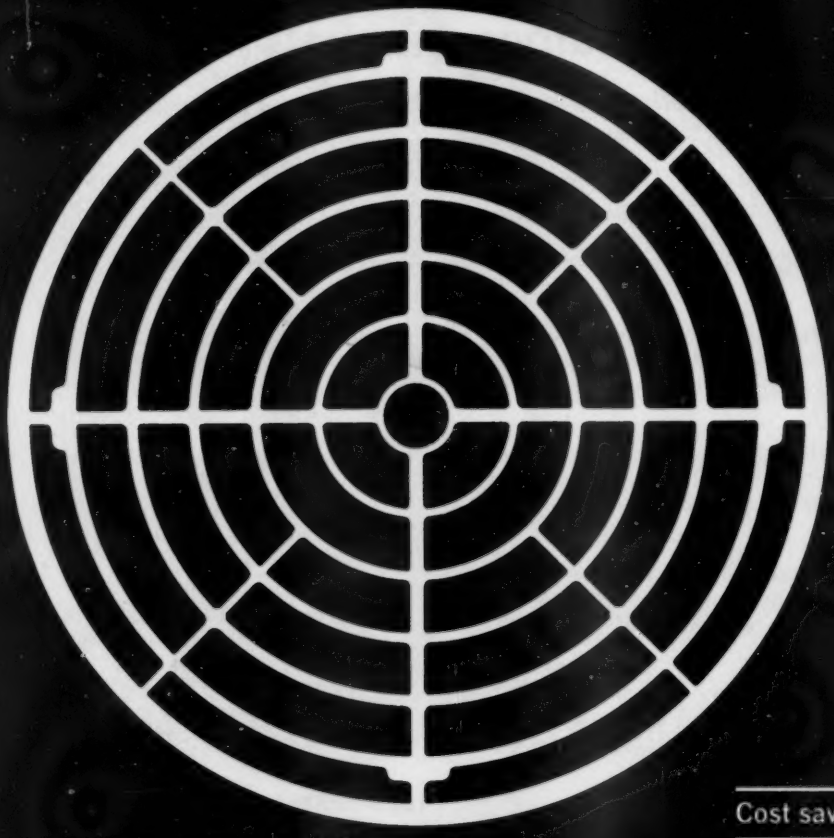
164 *Air Valves*—HANNIFIN CO.— Bulletin describes three new air valve models capable of filling and exhausting a 100 cubic inch load chamber from 0 to 90 psi in 0.15 second. A companion line of bases is also described.

165 *Aluminum Alloys*—OLIN ALUMINUM—24-page technical booklet lists the engineering properties of aluminum cast alloys and mill products.

166 *Metallic Hydrides*—METAL HYDRIDES, INC.—Technical bulletin describes how metallic hydrides can be used for "in-situ" generation of hydrogen through interaction with water.

167 *Metal Powders*—UNITED STATES BRONZE POWDERS, INC.—Data Sheet lists the chemical and screen analysis of atomized copper powders.

more Useful Literature on page 103



Cost saving: 33%

"are you getting your metal's worth?"

The intake tubes of the Waterous Company's model CMB fire pump suck in **1250** gallons of water a minute. Rocks and other foreign matter can get sucked in too—which would have disastrous effects on the pump. A screen is needed on the intake tubes, a screen that's tough and corrosion resistant, with extra-thin vanes and a smooth surface for unimpeded water flow.

Originally these screens were fabricated from sheet brass, with the vanes brazed together. An expensive material and method for a simple but important component. **Today these screens are die cast of Zamak at a cost saving of 33%** by Twin City Die Casting of Minneapolis. The tapered vanes have a minimum wall thickness of 1/32 of an inch. Zamak is the only die casting material that can fill these thin sections and still provide the strength, corrosion resistance and smooth "as cast" surface necessary.

To find out how you can put zinc die casting to work cutting your production costs, write today to The New Jersey Zinc Company for your set of Zamak technical data books detailing the properties, use, design techniques and machining practices of the Zamak alloys. Remember—Zamak gives you more for less. Are you getting your metal's worth?

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

HORSE HEAD PRODUCTS

useful literature, catalogs, manuals

175 *Metal Powders*—UNITED STATES BRONZE POWDERS, INC.—Tentative specifications for preblended bronze and copper powders.

176 *Tool Steels*—BETHLEHEM STEEL CO.—Classification of tool steels according to the AISI-SAE systems, includes comparison chart of tool steel trade names.

177 *Die Casting Machines*—A. TRIULZI—8-page brochure describes a line of hot and cold chamber die casting machines, including a model with a 2400-ton clamping force.

178 *Metal Powders*—UNITED STATES BRONZE POWDERS, INC.—Technical data on leaded brass powder grades B-129, and B-110.

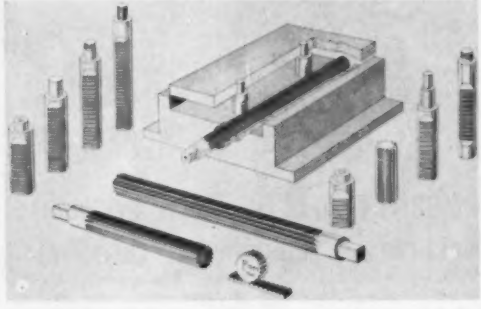
179 *Bronze Alloy*—AMERICAN SMELTING & REFINING CO.—Bulletin describes a bronze alloy for high strength, corrosion-free castings.

180 *Metal Powders*—UNITED STATES BRONZE POWDERS, INC.—Specification sheet covers aluminum, brass, bronze, copper, pre-blended bronze, and carbon brush powders.

more Useful Literature on page 104

REDUCE COSTS WITH PEERLESS "FLAME-A-LOY"® PINIONS & RACKS

for DIE CASTING MOLDS • PERMANENT MOLDS • PLASTIC MOLDS



- Standardized Sizes From Special Toughened Alloy Steels
- Accurate Cut Racks To Match Pinions For Longer Wear Life
- Catalog No. 167A Available To Users

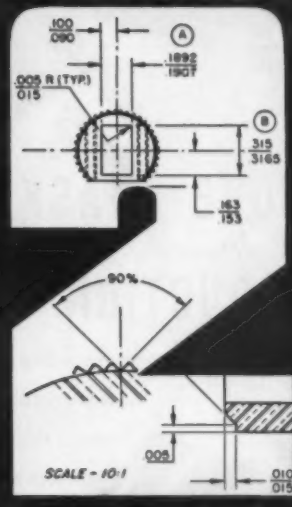
Established 1921 *Registered U.S. Pat. Office

PEERLESS GEAR & MACHINE CO., INC.

W. GENEVA AVE. • Phone: 3101 • DUNKIRK, OHIO

Circle No. 60 on Reader Service Card

BLUEPRINT FOR



Transforming these lines and numbers into the functional reality of a sintered brass brush holder for small electric actuator motors took teamwork. A design engineer conceived it, and a metal powder fabricator brought it to fruition—at a 65% cost saving over the previous method of manufacture.

It might not have been this way. Despite a design engineer's careful planning, his blueprint could be a neatly drawn recipe for an ulcer—when looked at by a metal powder fabricator aware of the advantages and limitations of his art. Often, a fabricator has little choice but to turn out a part he knows could be made infinitely better—could be made with increased reliability, more wearability, less machining and lower costs.

Working together, the metal powder fabricator and design engineer make economical mass production of critical parts a reality. And we also mean "critical" in the sense that a whole is no better than the quality of its most prosaic part. For more information about the design, application and advantages of nonferrous metal powder parts, write today to The New Jersey Zinc Company for your copy of "Designing For Pressed Brass and Nickel Silver Parts."

Part by KWIKSET POWDERED METAL PRODUCTS Division of American Hardware Corporation

HORSE HEAD® ATOMIZED NONFERROUS METAL POWDERS ARE PRODUCED BY

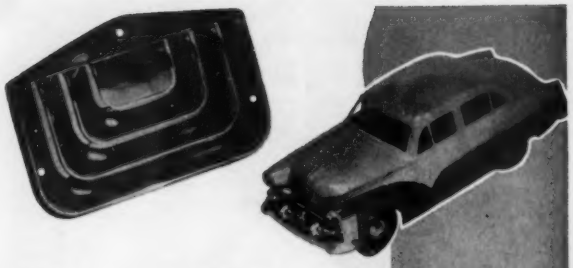
THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF BRASS & NICKEL SILVER POWDERS SETTING TODAY'S STANDARDS

HORSE HEAD PRODUCTS

Circle No. 56 on Reader Service Card



FIORE MASKS FOR PRECISION PRODUCTION PAINTING

Spray decorating methods have improved so rapidly in recent years that you may not be aware of some time-saving, money-saving techniques now available. Today, special Fiore designed spray masks and fixture devices make possible single or multi-color decoration with precise registration on irregularly contoured products.

IF { your product is judged on appearance
you want best possible results
you want a minimum of rejections
CONSULT US

Send for your FREE copy of our 20-page book which shows the different types of masks and gives case-study illustrations of their use. Or send your samples and drawings for consultation and estimates.

WM. M. FIORE INC.

269 41st Street Brooklyn 32, New York

Circle No. 96 on Reader Service Card

useful literature, catalogs, manuals

FINISHING

184 ***Marking Devices***—THE ACROMARK CO.—Bulletin lists the net prices of marking and numbering machines, tools, dies, and accessories.

185 ***Barrel Finishing Media***—ROTO-FINISH CO.—Bulletin describes a line of barrel and vibratory finishing media for polishing, britehoning, descaling, burnishing, and deburring.

186 ***Conversion Coating***—MACDERMID, INC.—3-page usage and instruction sheet on a chromate conversion coating for zinc or cadmium which eliminates the handling of liquid acid.

187 ***Painting Fixtures***—CONFORMING MATRIX CORP.—Brochure describes mechanical and air operated clamps for holding masks and parts, and standard and special fixtures for color decoration.

188 ***Buffing & Polishing***—HANSON-VAN WINKLE-MUNNING CO.—20-page bulletin describes a line of liquid and bar compounds for automatic and manual buffing and polishing.

189 ***Finishing Cast Steel***—DODGE STEEL CO.—Technical bulletin tells how to cut, weld, and heat-treat cast stainless steel.

PARAMOUNT QUALITY... chosen by Shakespeare Products for this automotive air conditioner part

Quality components make quality products. That's why Shakespeare Products Company chose Paramount to make the zinc and aluminum castings for this air conditioner part for a well-known automobile. Paramount *quality* coupled with engineering and production "know-how" are reasons why **it will pay you to look to Paramount.** Investigate Paramount's complete services *now*.

Three complete plants—two in St. Joseph, Mich., one in Seymour, Indiana.

SEND for "Designing for Die Casting"

PARAMOUNT *Die Casting Co.*

(A subsidiary of TALON, INC.) ST. JOSEPH 1, MICHIGAN

Circle No. 59 on Reader Service Card

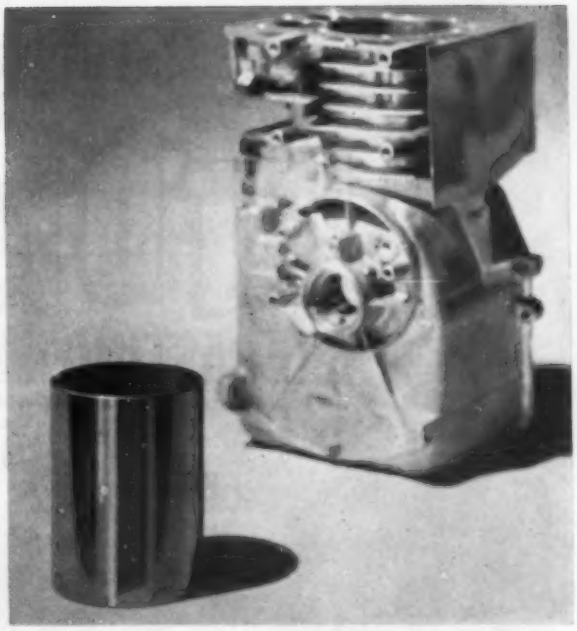
CYLINDER LINER CUTS RING WEAR

A NEW powder metal cylinder liner provides longer engine life and two-thirds less oil consumption according to the Amplex Division of Chrysler Corporation.

The liner has been put through numerous 500-hour full throttle tests, and is said to be ideally suited for small two and four-cycle engines. Besides reducing oil consumption, the liner also reduces ring wear. In fact, machining marks on the rings were clearly visible after a 500-hour full throttle test.

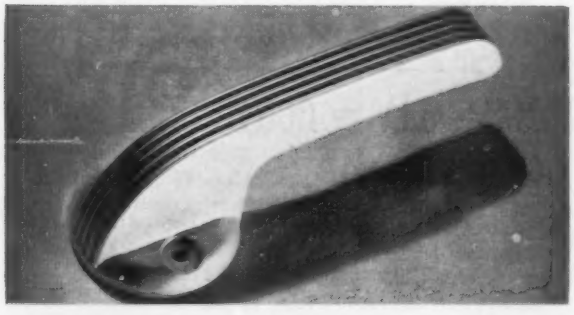
Amplex says that the development of a new Oilite alloy W-982 was the break-through which made the liner possible.

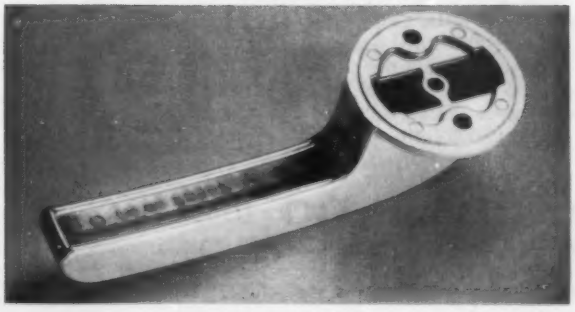
The liners are bonded into place in the engine by the infiltration of the aluminum cylinder wall. Precision powder metallurgy techniques often eliminate expensive machining of the liners. Many times honing is the only finishing required.



The liner is the result of three and one-half years of design and development effort by Amplex and engine manufacturers. Some engine manufacturers report that in addition to providing functional advantages, the liners reduce the cost of engines.

DIE CASTING SOLVES FINISHING PROBLEM





NO SINGLE REASON made the BullDog Electric Products Division, I-T-E Circuit Breaker Company, change from a sand casting to an aluminum die casting for the handle on their Fusible Vacu-Break Power Panelboard. It was a combination of reasons: lower cost, better tolerance, and better appearance.

The handle is a prominent part of an electrical bus duct plug and panelboard unit. It is the first thing that catches the eye, so looks are important. But BullDog Electric couldn't get the desired finish on the sand casting. They tried barrel finishing, grinding, buffing—but the sand casting still didn't look good enough. Holes in the ornamental grooves looked particularly bad. Now all they do to get a good-looking die casting is to bright dip and ball burnish. Litemetal Dicast, Inc. makes the handle.

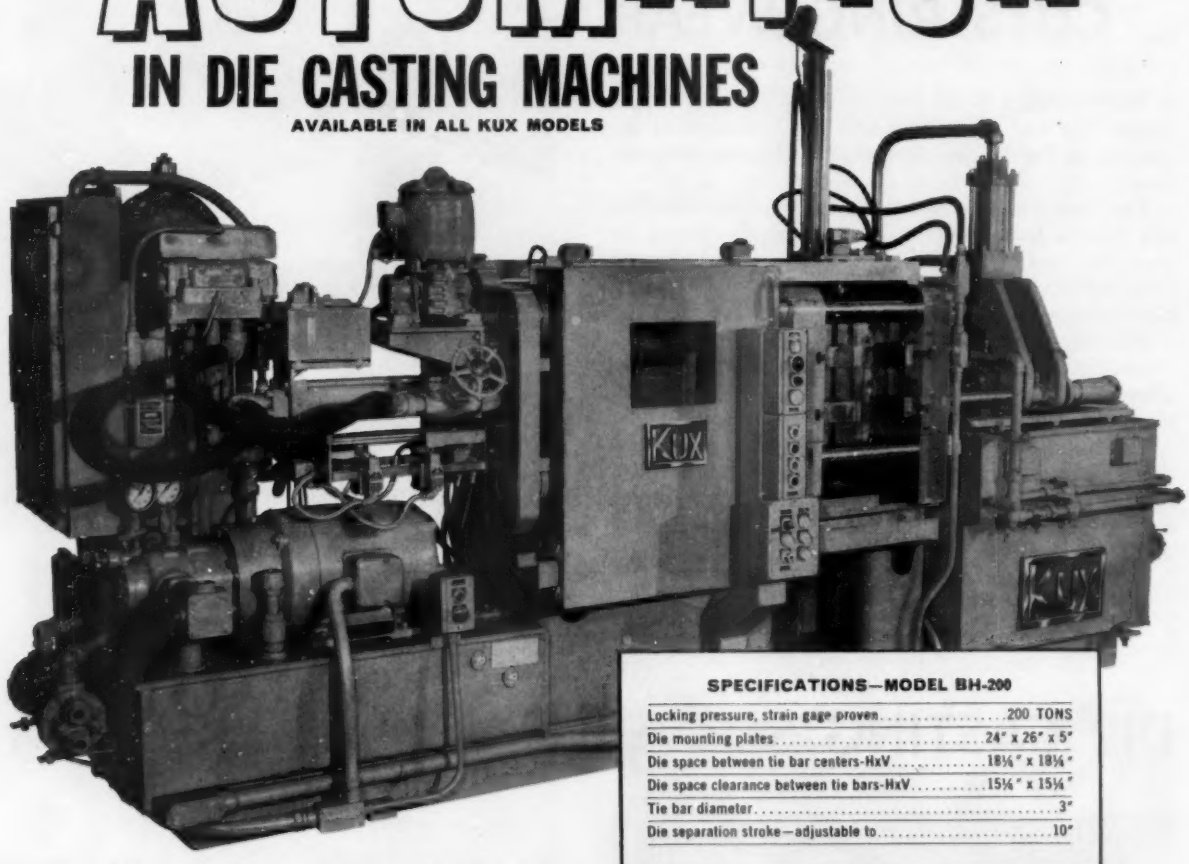
Although the handle is an intricate-looking part, it needs no machining. The three holes have a tolerance of $\pm 0.003''$ and aren't even reamed. The other dimensions are held to $\pm 0.010''$.

Another **KUX** unsurpassed design superiority

AUTOMATION

IN DIE CASTING MACHINES

AVAILABLE IN ALL KUX MODELS



SPECIFICATIONS—MODEL BH-200

Locking pressure, strain gage proven	200 TONS
Die mounting plates	24" x 26" x 5"
Die space between tie bar centers-HxV	18¼" x 18¼"
Die space clearance between tie bars-HxV	15⅛" x 15¼"
Tie bar diameter	3"
Die separation stroke—adjustable to	10"

Up to 900 free cycles per hour . . .
500 to 700 casting cycles per hour } AUTOMATICALLY — CONTINUOUSLY

You're looking at the new KUX Model BH200—the 200-ton strain gage proven hot chamber die casting machine, which will continuously produce vast quantities of hardware finish castings with minimum maintenance and down time. Automatic operating mechanism permits a cycle with a full 10" of die movement and 6" of metal injection stroke in 4 seconds. A 6¼ lb. zinc shot can be produced in this heavy duty machine at 1800 PSI injection pressure. Sensing safeties retract the die plate and prevent recycling of machine if there is flash on the die surfaces.

Incorporated into this machine cycling mechanism is a low pressure approach of the moveable die plate, flash sensing switches, air jets for cleaning die faces, casting sweep arm, and die lubricating unit with adjustable interval timing. Also available in cold chamber models for casting aluminum with KUX "AUTO-FEED" system of vacuum die casting.

ADDITIONAL FEATURES in the 28 all-new strain gage proven KUX models are the revolutionary "VAC-U-DIE" and "AUTO-FEED" systems of vacuum die casting—motorized die height adjustment mechanism—and the patented KUX injection pressure multiplier for cold chamber models with injection pressures up to 36,000 PSI and plunger speeds up to 12,000 inches per minute.

KUX MACHINE CO. (Dept. P)
6725 North Ridge Avenue, Chicago 26, Illinois

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

Circle No. 43 on Reader Service Card

PMM

data offered in this month's ads *qualified readers may obtain these free reference materials by circling the numbers on the reader service cards*

1. **Colloidal Graphite**—Acheson Colloids Co.—Brochure gives technical data on colloidal graphite dispersal as they apply to lubricating problems.

2. **Additives**—Alan Wood Steel Co.—Technical bulletin gives data on the use of carbon additives.

11. **Investment Casting**—Atlantic Casting & Engineering Corp.—Information available on casting a full range of non-ferrous alloys.

15. **Compacting Presses**—Baldwin-Lima-Hamilton Corp.—Data sheet gives specifications for 200-ton mechanical compacting press.

17. **Trim Presses**—B.I.P. Engineering Ltd.—Bulletin describes a 50-ton semi-automatic or manual trim press.

21. **Tool Steels**—Crucible Steel Co. of America—Information on high-hardness CSM-2 and NU-Die mold and die steels.

24. **Die Casting Dies**—Damen Tool & Engineering Co., Inc.—Brochure shows engineering processes and facilities available in making die casting dies.

25. **Crucibles**—Denver Fire Clay Co.—Catalog gives full information on its line of crucibles and funnels.

29. **Shell Mold Parting Agents**—Dow Corning Corp.—Manual describes the use of silicone parting agents in shell-molding.

30. **Die Cast Dies and Molds**—The Efficient Tool & Die Co.—Booklet gives data on wide range of equipment available.

32. **Die Compound**—Fiske Brothers Refining Co.—Booklets describe compounds for cleaning castings.

34. **Tiny Zinc Die Castings**—Gries Reproducer Corp.—Bulletin includes designer's check list for small zinc die castings.

35. **Die Casting**—Hampden Brass & Aluminum Co.—Brochure describes services and facilities for die casting.

OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered for the first time in this issue by new PMM advertisers.

23. **Reamers**—Conical Tool Co.—Catalog gives information on reamers and tooling equipment.

31. **Die Casting Machines**—E.M.B. Co. Ltd.—Offers die casting machines which feature a quick 2-hour change from hot chamber to cold chamber.

36. **Lapping Compound**—Wheel Trueing Tool Co.—Bulletin describes selection of particle sizes in diamond lapping compound.

37. **Investment Casting**—Hitchiner Manufacturing Co.—Technical information on the ceramic shell investment casting process.

39. **Hydraulic Fluids & Packings**—E. F. Houghton & Co.—Table describes packing fluid compatibility for hydraulic systems.

41. **Powdered Metals**—Hoeganaes Sponge Iron Corp.—Technical brochure tells how iron and high alloy powders can vastly improve product and reduce production costs.

43. **Die Casting Machines**—Kux Machine Co.—Catalog describes an entire line of die casting machines.

45. **Heating Equipment**—Lepel High Frequency Lab., Inc.—Catalog lists complete line of high frequency induction heating units.

46. **Die Casting Machines**—Lester-Phoenix, Inc.—Bulletin gives detailed specifications on die casting machines ranging in capacity from 100 to 1600 tons for aluminum or zinc.

47. **Die Castings**—Madison-Kipp Corp.—24-page book shows how to solve die casting problems.

53. **Fire Resistant Hydraulic Fluids**—Monsanto Chemical Co.—Bulletins tell how to prevent fire in die casting machines with the right hydraulic fluid.

54. **Compacting Presses**—Morton Manufacturing Co.—Data available on compacting presses ranging from 25 to 200 tons with hydraulically controlled floating die table.

55. **Metals and Alloys**—The New Jersey Zinc Co.—Technical data books describe use of Zamak alloys in die casting.

56. **Metal Powders**—The New Jersey Zinc Co.—Technical brochure on "Designing for Pressed Brass and Nickel Silver . . ." powdered metal parts.

57. **Die Casting**—Newton-New Haven Co.—Folder for designers and product planners explains the PDCS process for die casting.

59. **Die Castings**—Paramount Die Casting Co.—Technical brochure describes how to design for die casting.

60. **Pinions and Racks**—Peerless Gear & Machine Co.—Catalog describes pinions and racks for users of die casting and permanent molds.

61. **Lubricating Equipment**—Pierce-Waller, Inc.—Information on a system for lubricating, cleaning and cooling molds.

62. **Pots—Pottstown Machine Co.**—Brochure describes a line of melting kettles for lead, zinc, and aluminum industries.

64. **Die Casting Machines**—Reed-Prentice Div. of Package Machinery Corp.—Technical information on new developments in automatic operation of large hot and cold die casting machines.

more Data in Ads on next page

NEEDED: EQUIPMENT FOR LIGHT METAL CASTING

3 out of 5 visitors at AFS Expositions—including die casters and permanent molders—take purchasing action on new equipment. There will be 16,000 top foundrymen at the 1962 Exposition . . . tell them YOUR story with a display at

THE BIGGEST FOUNDRY EXPOSITION IN 10 YEARS

66th CASTINGS CONGRESS and EXPOSITION

PLUS

29th INTERNATIONAL FOUNDRY CONGRESS

DETROIT
MAY 7-11, 1962
COBO HALL

FOR SPACE
WRITE, WIRE, PHONE

AMERICAN FOUNDRYMEN'S SOCIETY
GOLF & WOLF ROADS
DES PLAINES, ILL. • VA 4-0181

data in ads

65. Powdered Metal Parts—Reese Metal Products Corp.—Brochure shows how to cut precision parts costs with the Remet powdered metal process.

68. Pots—Tiffin Foundry, Inc.—Brochure lists a complete line of stock pots and die casting machine accessories.

70. Tool Steels—Uddeholm Co. of America—Technical information on tool steels for die casting and extrusion.

72. Investment Castings—Vascoloy-Ramet Corp.—Data on investment castings made in metals to meet specific requirements.

73. Die Casting Machines—DCMT Sales Corp., Div. of British Industries Corp.—Literature on DCMT Mac 99 and the Ram die casting machines.

74. Steel Finishing Balls—Abbott Ball Co.—Technical bulletin AP-1 describes barrel-finishing media for producing mirror-like finishes.

78. Plating—Oakite Products, Inc.—Bulletin describes various types of cleaners available to be used in connection with the plating process for clean, spot-free finishing.

79. Vibratory Finishing—Syntron Co.—Catalog on its complete line of compact electromagnetic vibratory barrel finishing machines.

81. Melting and Holding Furnaces—J. A. Kozma Co.—Technical information on its aluminum and magnesium melting furnaces ranging from 600 to 2,000 lbs. per hour. Also on holding furnaces for die casting and permanent molding.

86. Trim Presses—Parker-Hannifin Corp.—Bulletin describes high speed hydraulic trimming presses.

87. Fire-Resistant Hydraulic Fluids—Union Carbide Chemicals Co.—Information on Ucon safety hydraulic fluids.

88. Refractories—Harbison-Walker Refractories Co. & Subsidiaries—Test data and product description show resistance of refractories to aluminum alloy reaction.

91. Die Making and Maintenance—Hyprez Div., Engis Equipment Co.—Illustrated price list shows Di-Profiler and accessories to be used in making and maintaining dies.

Circle No. 27 on Reader Service Card

is
YOUR
PROBLEM

BRASS

?

DIE CASTINGS

•

ENGINEERING ASSISTANCE
DIES
PRODUCTION
ZINC • ALUMINUM • BRASS

call us now
or
send prints for
prompt evaluation & quotation

DIECASTERS, INC.
Closter, New Jersey
Telephones:
POplar 8-5400
N.Y. LAckawanna 4-0320

STILL THE
PRIME SOURCE
OF PURE,
AIR-STABLE

TITANIUM METAL POWDER

for powder metallurgy, titanizing, alloying, rocket propellants pyrotechnics, etc.

process recently acquired from United International Research, Inc.

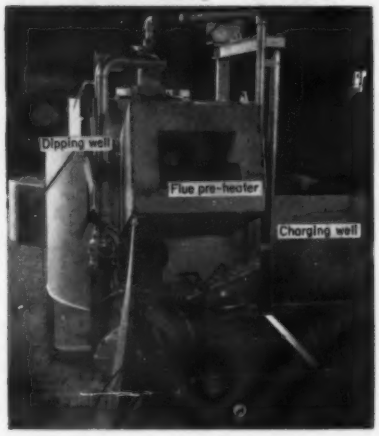
Rare Metals Division
Consolidated Astronautics inc
38-15 30TH STREET
LONG ISLAND CITY, NEW YORK

Circle No. 22 on Reader Service Card
PRECISION METAL MOLDING

new products & developments

Continued from page 23

New design concept in reverbatory furnaces



ALUMINUM AND MAGNESIUM INC. —This reverbatory furnace heated by a roof-installed burner is based on a new concept in furnace design. The burner mixes and burns fuel and air within the burner nozzle, confining the flame to within inches of the burner tile. The flame flattens out parallel to the tile instead of shooting out into the heating chamber. This permits the lowering of the furnace roof to within inches of the metal in the heating chamber because the heat is transferred principally by radiation with no direct flame on the metal.

Because the new design can use a smaller combustion chamber, heat losses are greatly reduced, and working conditions for operator and equipment are improved.

An outside charging well eliminates direct charging into the melting chamber and resultant oxide formation. New or run-around metal can be fluxed and treated prior to its entrance into the heating chamber. Round furnace design means that the charging and ladling wells can be located at any angle. Cleaning is simplified, and the furnace is more compact and lighter.

The builders say that the furnace is actually a much-reduced version of a smelter's furnace.

Circle No. **240** on Reader Service Card

more New Products on next page

Circle No. **95** on Reader Service Card

SELLERS OF

'METALKAT'
BRAND ELECTROLYTIC ZINC

SPECIAL HIGH GRADE 99.995% +
HIGH GRADE 99.95%

INDUSSA CORPORATION
511 Fifth Avenue New York 17, New York Tel: MUrray Hill 2-4680
Cable: Indussa New York—Telex: RCA 4030 N.Y., AC&R 0943 M N.Y., TWX N.Y. 1-3817

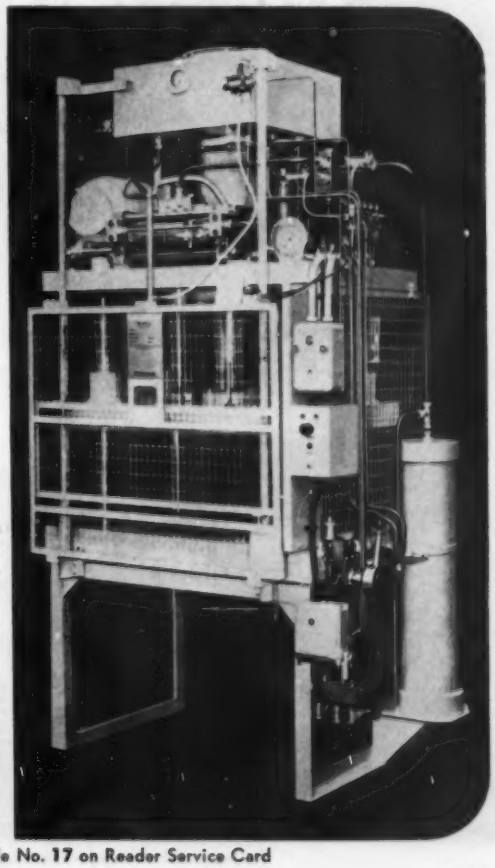
SPEED UP YOUR TRIM OPERATIONS!

Here's Bipel's 50-ton Semi-Automatic Trim Press that gives you a faster approach and a faster advance through the work! Dry cycle time is only 3 seconds. This flexible, clean-trimming unit offers a choice of 3 pressures . . . 17, 34 or 50 tons (intensified within the press) . . . semi-automatic or manual control. Complete operator safety, too. Write for illustrated bulletin.

B. I. P. ENGINEERING LTD.
Sutton Coldfield, England

RALPH B. SYMONS ASSOCIATES, INC.
3569 Main Road, Tiverton, R. I.

BIPEL®



Circle No. **17** on Reader Service Card

new products & developments

Continued

Centrifugal casting machine

DESIGN ENGINEERING & PRODUCTS CO.—These horizontal centrifugal casting machines are equipped with gas mold heating and high velocity water cooling for maintaining desired mold temperature during the casting operation. The units have pneumatically operated mold spray equipment for spraying linings into permanent molds. Castings may also be produced in sand lined flasks.

Circle No. **241** on Reader Service Card

Silicon rectifiers

ALLIED RESEARCH PRODUCTS, INC.—A new line of silicon rectifiers has been introduced which features smaller size, lower price, and flexibility in arrangement.

Though the cabinet size has been reduced, this new line matches larger rectifiers in performance. Over-size heat sinks and increased capacity of diodes, in addition to an extra large fan, keep the unit cool.

Units are available in capacities of 1000, 1500, 2000, 2500 and 3000 amps with a wide choice of control regulation.

Circle No. **242** on Reader Service Card

Spray gun pattern changer

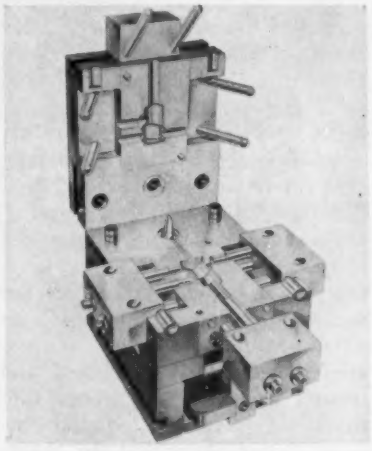
THE DEVILBISS CO.—A push-pull device, enabling an instant change from a broad spray pattern to a narrow one, is now available for the P-MBC or MBC model spray gun.

An instant switch can be made without losing the original pattern setting, which cuts down on needless overspray, saves cleanup time, and eliminates stops to readjust the gun.

Circle No. **243** on Reader Service Card

Single station unit die

RICHARDS TOOL & MOLD CO.—The single station Master-Mold unit die is especially suited for automatic cycling. It is capable of performing the operations of any conventional mold with as much as 70% cost reduction.



The unit has removable sections on either side so that die casters can incorporate side core pulls for each or any of three sides. It also has an added automatic kicker pin for positive ejection of castings.

Circle No. **244** on Reader Service Card

WILL GIVE YOU THE CORRECT ANALYSIS OF THE ECONOMIES TO BE OBTAINED FROM DIE CASTING IN ZINC OR ALUMINUM IN ANY QUANTITY.

BADGER DIE CASTING CORP. 201 W. Oklahoma Ave. Milwaukee 7, Wis.

Circle No. **14** on Reader Service Card

Lifting magnets

D-M-E CORP.—The My-T-Mag lifting magnet is available in two sizes with lifting capacities of 1500 and 4500 pounds. The device ends the

possibility of damage to surfaces and finishes, and eliminates time spent in rigging hooks, chains, and eyebolts.

This compact unit contains a built-in rectifier which operates on any 110/120-volt line, either AC or DC. It is operated by a heavy-duty toggle switch on the unit which quickly magnetizes or de-magnetizes the unit.

Circle No. **245** on Reader Service Card

Tubular linings

THE CARBORUNDUM CO.—Fiberfrax tubular linings for high-temperature ducts, pressure vessels, molten metal transfer systems and induction furnaces are made from laminated ceramic fiber paper. The linings, designed for use at 2300°F for extended periods, are lightweight and rigid. They can be used at higher temperatures for a limited time.

Circle No. **246** on Reader Service Card

Hammermills

AMERICAN PULVERIZER CO.—Special-purpose hammermills for use in salvaging rejects are gaining wider use by manufacturers in powder metallurgy. Green powdered metal compacts damaged in pressing or handling are quickly reduced to original fineness by these hammermills. This process is relatively simple regardless of metal composition or compacting pressure.

Circle No. **247** on Reader Service Card

more New Products on page 113

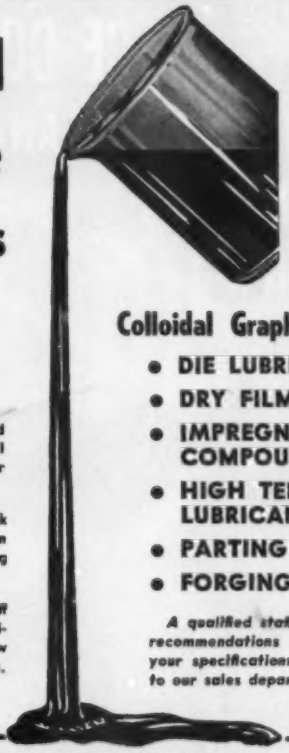
Circle No. **33** on Reader Service Card

Colloidal Graphite dispersions

can help you

3 WAYS:

1. **Production** — For established production processes we will prepare dispersions to meet your specifications.
2. **Development** — We will work directly with your engineers on development projects requiring specialized dispersions.
3. **Research** — Our research staff is always available for consultation on new products, new processes and new applications.



Here are a few uses of

Colloidal Graphite Dispersions:

- DIE LUBRICANT
- DRY FILM LUBRICANT
- IMPREGNATING COMPOUND
- HIGH TEMPERATURE LUBRICANT
- PARTING COMPOUND
- FORGING COMPOUND

A qualified staff is available for prompt recommendations and quotations to meet your specifications or preliminary inquiries to our sales department.

GRAPHITE PRODUCTS CORP.
BROOKFIELD, OHIO

Call on us for BOTH...

carroll

donald carroll metals inc.
201 north division street
bensenville,* illinois

POrter 6-5500

ZINC & ALUMINUM ALLOYS

ENGINEERED TO GIVE YOU
- HIGH FLUIDITY
- SUPERIOR FINISH
- DENSE CASTINGS

* ADJACENT TO O'HARE FIELD & ILLINOIS TOLLWAYS

Circle No. **19** on Reader Service Card

LOWER your PIECE COST with ATLANTIC PLANAR INVESTMENT CASTING

- ▶ Up to 300 PIECES PER MOLD
- ▶ UP to 80,000 PIECES PER DAY
- ▶ TOLERANCES for CRITICAL DIMENSIONS to ± .003
- ▶ SURFACE FINISHES AS CAST to 125 MICROINCHES or BETTER
- ▶ BURN-OUT, BREAK-OUT and CUT-OFF TIME CUT IN HALF
- ▶ FULL RANGE OF NONFERROUS ALLOYS for EXCEPTIONAL STRENGTH, CORROSION RESISTANCE and LIGHT WEIGHT.

write or phone for complete information . . . prints will bring a prompt quotation

ATLANTIC
CASTING & ENGINEERING CORP.
810 Bloomfield Avenue / Clifton N. J. / PRescott 9-2450

Circle No. **11** on Reader Service Card

WHAT'S NEW IN SURFACE FINISHING?

Continued from page 24

quite common. These faults have been overcome by the new materials. This should broaden the field of application for porcelain enameled aluminum parts.

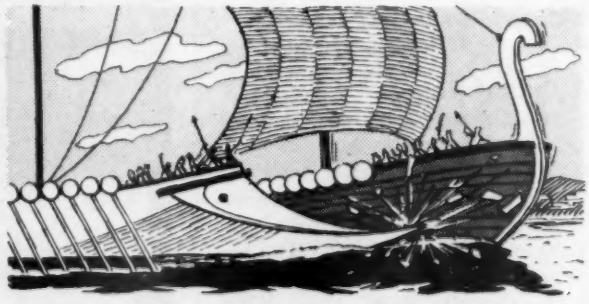
One of the latest materials to be announced is a low temperature frit for aluminum which is reported to give a surface considerably harder than ordinary glass and with many times the abrasion and corrosion resistance of older enamels. This material is for non-decorative uses only.

Paint and lacquer finishes

For the best quality finishes and maximum corrosion resistance it is still necessary to apply a chemical conversion coating to zinc and aluminum parts before painting or lacquering.

New materials and methods in chemical conversion coatings have been developed which give better corrosion protection, better tooth, and can be applied at lower costs.

In the paint and lacquer field there have been materials developed which are specifically designed for coating die castings. These organic coatings contain a considerable amount of flake aluminum and are claimed to have exceptionally good hiding so that less perfect surfaces are required on the metal parts.



"SPIKES" IN LAPPING COMPOUND CAN DO LOTS OF DAMAGE, TOO!

Long, sharp "spikes" that gouge or even just scratch, don't belong in diamond lapping compound. To keep them (and *all* unwanted matter) out of Trulap® Diamond Lapping Compound, we make Trulap in a laboratory, using blocky diamond shapes of uniform size—"spikes", "blades", "jumbos", "fines" are out. So, with Trulap, you get the greatest lapping mileage for least cost because Trulap diamond powder is the right shape, accurate size, evenly dispersed throughout the paste. For extra value, new Trulap contains Granulaide*, which keeps new Trulap working for you long after ordinary compounds would be expended. Available in America's widest selection of accurately graded particle sizes and in dispensers from 2½ gr. up. Write for bulletin.

*T.M. OF W.T.T. CO. FOR ITS SURFACTANT

TRULAP **WHEEL TRUEING TOOL COMPANY**
236-3200 W. Davidson, Detroit 38, Mich.
575 Langlois Ave., Windsor, Ont., Canada

A research development of Wheel Trueing Tool Company. Over 50 years a leader in diamond products.

Circle No. **36** on Reader Service Card

Automatic tapping unit

THE ELECTRO-MECHANO CO.—A tapping capacity range from #4-40 through #10 is available with this

small automatic tapping unit with a tap speed range from 750 to 3000 RPM in seven steps. It has an electric motor-driven spindle with an air cylinder for the feed.

Circle No. **248** on Reader Service Card

Control equipment

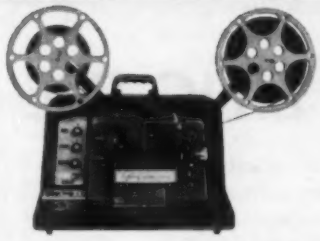
THERMO ELECTRIC CO.—An electronic proportional controller provides accurate, dependable, proportional off-on process control. Process conditions cannot exceed pre-set limits.

Circle No. **249** on Reader Service Card

more New Products on page 118

Circle No. **65** on Reader Service Card

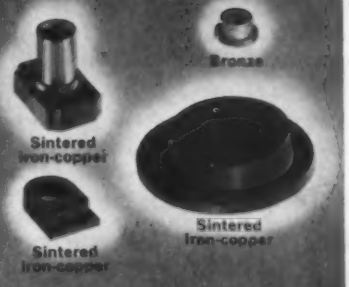
6th IN A SERIES of POWDERED METAL PARTS applications by REESE



GRAFLEX chooses REESE POWDERED METAL PARTS

FOR LOW COST AND DIMENSIONAL STABILITY

In its all new 16 MM Galaxy Projector, Graflex, Inc. employs 4 powdered metal parts by Reese. Here's why: Complex configurations are "naturals" for powder. Even with tolerances held to .0005", costs are anywhere from 50% to 80% less than in machined parts. And the Reese laboratory assures the best alloys for dimensional stability, strength, wearability, etc. Reese oil impregnation, when desired, also offers permanent self-lubrication. Investigate all the advantages of Reese powdered metal parts.



FREE BROCHURE

"How to Cut Precision Parts Costs with the Remet Powdered Metal Process" shows how Reese can help you. Send for your copy today.

REESE METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams
Ratchets • Bushings
Machine and Structural Parts in
COPPER • BRASS • IRON
ALLOY STEEL • NICKEL SILVER
COPPER INFILTRATED IRON

a new source of supply...

Cut Production Cost... Improve Quality

with die cast components!

Southern Die Casting and Engineering serves the furniture industry with components that lead to better made, better designed furniture! Drawer-pulls, chair and table bases, and supports are but a few of the parts Southern Die Casting can supply to help you manufacture better products. The chair back-support featured was the answer for one manufacturer: Southern Die Casting found a way to make this support in one piece to take the place of the previous three-piece unit. This eliminated costly welding and extra-step assembly. Looks better, too! Southern Die Casting has the experience and facilities to assist you with your designs. Submit sketches or inquire for further information today.

SOUTHERN DIE CASTING & ENGINEERING
High Point, North Carolina

Circle No. **90** on Reader Service Card

GATING ZINC DIE CASTINGS

By **RALPH WILCOX**, *Metallurgist, American Smelting and Refining Co.*

This is the fourth and concluding article in a series by Mr. Wilcox concerning current practices for gating zinc die castings. Parts I, II, and III of this series appeared in May, June, and July, 1961.

GATE DETAILS

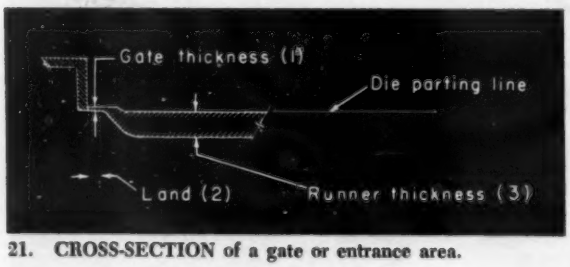
THE THICKNESS of the gate opening is more of a factor in obtaining good surface finish than is commonly realized. With a thin gate (about .020" to .030") the metal being injected into the die has a greater tendency to spray rather than to flow into the casting cavity. For this reason it is usually more difficult to obtain good finish with a thin gate than with a heavy gate (about .040" or more).

Most die casting plants err on the side of having the gate too thin. The reason for this is that the trimming department usually objects to trimming a gate much over .035" to .040", claiming that thicker gates are difficult to trim, cause breakouts, etc. Whereas actually with a properly supported trimming die, gates as heavy as .060" to .065" can be removed with little difficulty.

Unfortunately, the casting department tries to please the trimming department all too often by keeping the gate too thin and then obtaining the necessary gate area by lengthening the gate opening or adding supplemental openings. As a result, loss in the form of rejected castings for poor surface finish is far greater than the slight additional initial cost that would be involved in building proper trimming tools to trim a slightly heavier gate.

It is sometimes less costly in the final analysis to use a gate thickness of .060" or more when necessary to obtain good finish even if this means removing the gate by sawing or other methods more costly than die trimming.

A cross section of a gate or entrance area with important dimensions is shown in Figure 21.



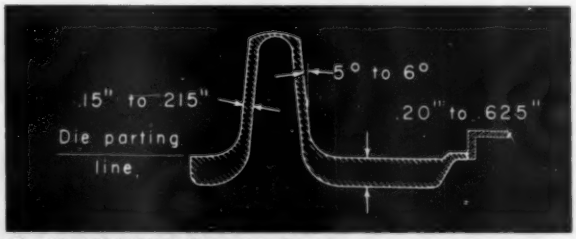
21. CROSS-SECTION of a gate or entrance area.

RUNNER AND SPRUE DETAILS

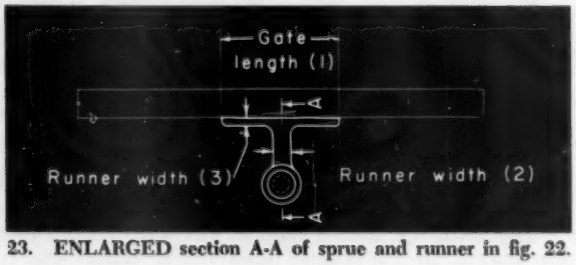
Gate runners are usually placed in the ejector or moveable half of the die along with that part or surface of the casting that does not require a hardware finish. In this way, the runner can be adequately cooled without chilling the stationary half of the die. Furthermore, with runners in the ejector half of the die there is less danger of damage to the die if an ejector pin breaks.

Adequate cooling of the runner and gate are essential because it not only permits a higher rate of production but also influences surface finish. The moment a casting cavity has been filled with liquid metal, the pressure must be sealed off by solidifying the gate area. This action can be likened to the act of inflating a balloon and the retention of air or gas pressure by sealing the neck or entrance area of the balloon.

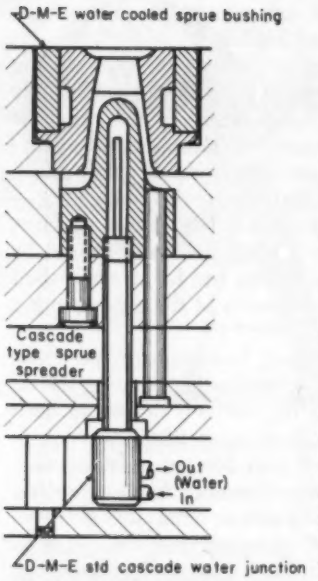
For the pressure in the die casting process to be effective, the metal injected into the runner, gate,



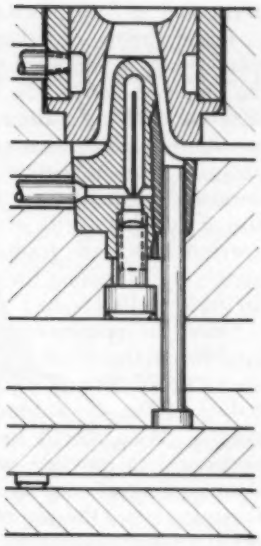
22. PLAN VIEW of sprue and runner.



23. ENLARGED section A-A of sprue and runner in fig. 22.



24. CASCADE TYPE sprue spreader and sprue bushing.

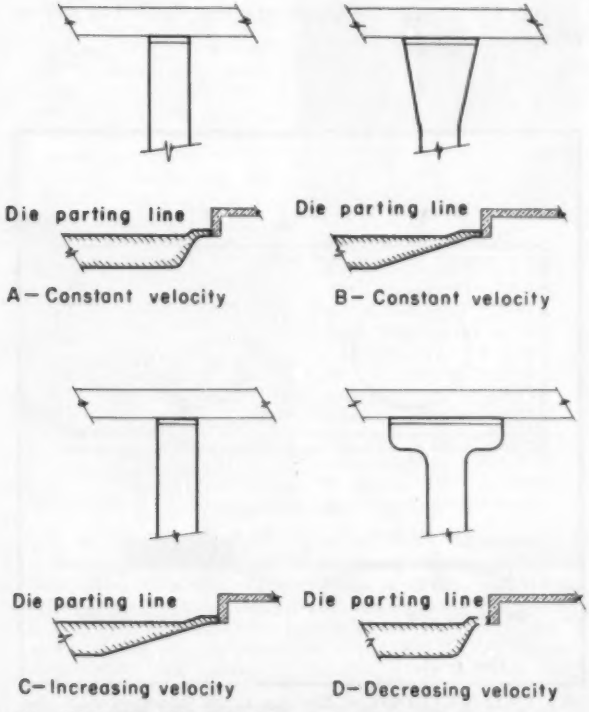


25. REGULAR TYPE sprue spreader and sprue bushing.

casting cavity and overflow wells must remain liquid for a fraction of a second so that pressure can be transmitted equally throughout and hold the molten alloy firmly against the die surface until the pressure can be sealed off by freezing or solidifying the gate. Obviously if the gate area is solidified too soon or too late the effective pressure will be dissipated with resultant adverse effect upon surface finish. Some important dimensions of sprue and runner are given in figures 22 and 23.

Two examples of a popular design, water cooled, sprue spreader and sprue bushing are shown through the courtesy of Detroit Mold Engineering in figures 24 and 25.

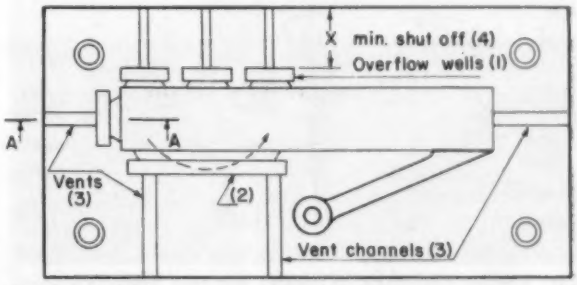
The shape or cross section of the runner from the sprue to the gate can be held constant or varied to obtain a constant or changing velocity of the stream of metal. Four different gate runner designs are shown in figure 26. All four designs have been used successfully in specific applications. However, runner designs that yield a constant or decreasing velocity between the sprue and the gate are favored over other designs.



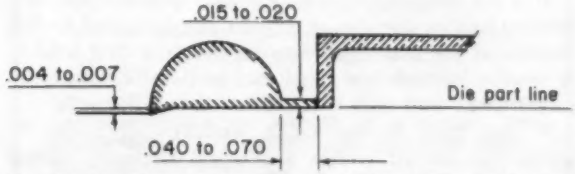
26. RUNNER SECTIONS for various flow velocities.

OVERFLOW WELL DETAILS

The importance of overflow wells as an aid to the production of sound castings cannot be overemphasized. Gate runners are always sound and free from entrapped air because the casting serves as an overflow well for the runner. Therefore, on castings requiring optimum soundness, provide sufficient overflow well capacity so that the casting in effect serves as the runner for the overflow well.



27. PLANVIEW of a casting with gate and overflow wells attached in place in the ejector half of the die.



28. ENLARGED cross section A-A of overflow and vent channel in fig. 27.

Overflow wells not only provide an exit for the air from the casting cavity but also serve to draw metal around a corner or core and help maintain a uniform die temperature.

The importance of and the need for overflow wells was clearly demonstrated as early as 1937 by G. L. Werley who found that in order to develop an A.S.T.M. test bar die to die cast a simple impact test by 6" long by ¼" square with optimum soundness and mechanical strength, the overflow volume had to be

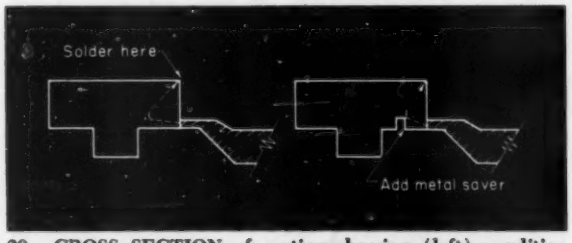
0.6 cu. in. or almost twice the volume of the test bar itself. In addition, the gate thickness had to be .088"!

Figure 27 presents a plan view of a casting with sprue, runner, gate and overflow wells attached in place in the ejector half of the die. This shows a typical arrangement of overflow wells and vent channels. A cross section of an overflow well and vent channel showing some important dimensions is presented in figure 28.

On certain complicated shaped castings with intricate coring some air may remain trapped in the casting regardless of the size and number of overflow wells, extent of venting, etc. In these cases evacuating the die prior to the injection of the metal by means of a vacuum attachment has proved helpful.

GATING TO AVOID SOLDERING OF THE DIE

Soldering is a condition where the metal being injected into the cavity builds up upon the die surface through the mechanism of alloying with the die steel. This condition leaves depressions on the casting that in many cases cannot be removed by polishing or oiling.



29. CROSS SECTION of casting showing (left) condition conducive to the formation of solder and (right) placement of metal saver to change direction of incoming metal flow.

If a die solders, this usually takes place in the stationary half of the die at or near the gate end or hot portion of the die. Furthermore, the area that solders is usually located in a dead end of the die where the metal backs into rather than flows across the area.

A thin gate increases the tendency of a die to solder because it causes the metal to spray rather than to flow into the die. Furthermore, a thin gate tends to generate more heat than a thick gate because of the greater resistance it offers to the passage of the incoming metal.

Soldering of the die can usually be eliminated by increasing the thickness of the gate opening and/or relocating the gate to cause the metal to flow across the area that solders. Sometimes because of the nature of the casting, layout in the die, parting plane, etc. it is impossible to relocate the gate. In this case it may be possible to add a metal saver that alters the flow of the incoming metal sufficiently so that it splashes against or washes over the critical area. This is illustrated in figure 29.

GATING AND DIE TEMPERATURE

With the best of gating methods a die must be operated at a temperature high enough to eliminate chills and run marks but low enough to prevent the formation of heat pits and blisters.

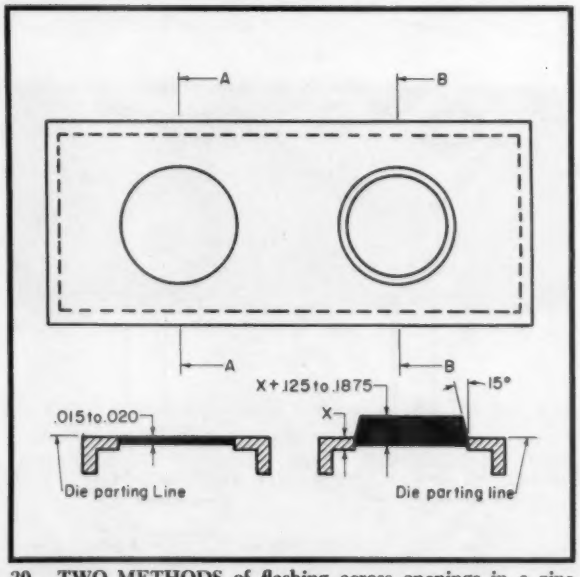
Based upon observations made in die casting plants over a period of years good finish can usually be obtained with a die temperature in the range of 300° to 400°F. If a die must be maintained at a temperature much in excess of this to obtain good finish, this is a good indication that the method of gating – runner design, placement of gate, thickness of gate, use of overflow wells, etc. – is at fault and should be corrected. In many instances this can be accomplished simply by increasing the thickness of the gate opening by .010" to .015".

Once the proper operating temperature has been established this is usually controlled by running water, steam or air through cooling channels drilled in both halves of the die at positions most likely to require cooling. With dies 4 to 6 feet long it is sometimes necessary to provide supplemental heating rather than cooling at locations farthest from the gate. In these instances the use of oversized overflow wells at positions farthermost from the gate will reduce the amount of supplemental heating required.

FLASH ACROSS OPENINGS WHENEVER POSSIBLE

In figure 30 the two circular openings in the casting constitute obstacles to the flow of the metal no matter where the gate is located. However, closing the openings with a .015" to .020" flash, which can be removed later in the trimming operation, allows uninterupted flow and promotes good surface finish.

Two methods of flashing across openings are shown in sections A-A and B-B of figure 30. The flash shown in section A-A is more difficult to remove than that shown in section B-B because the trimming die would have to incorporate an accurately positioned punch. This is not required with the opening flashed as shown in section B-B.



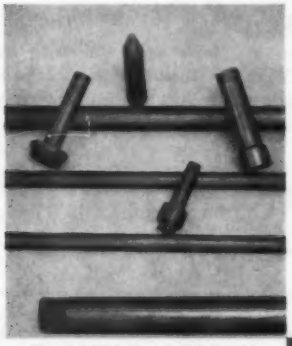
30. TWO METHODS of flashing across openings in a zinc die casting.

Q WHAT ONE MATERIAL

can be used up to 3000°F—is nearly impervious to abrasion and corrosion—can be formed to ± .005 in./in.—and even withstands molten aluminum?

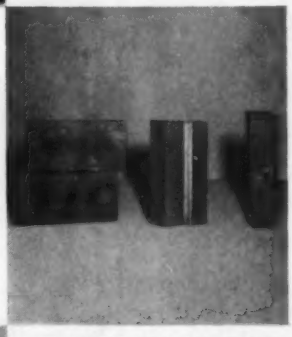
A Carborundum's nitride bonded silicon carbide — REFRAX® refractory

This extra hard, very strong material looks like cast iron—wears like no other known refractory or cement—yet costs little more than standard silicon carbides. And it's worth?—you judge from the examples below.



EXAMPLE: Cast iron pyrometer tubes immersed in molten aluminum average 70 hours' life. When replaced with REFRAX tubes, life is *ten times* longer. Iron pouring spouts in molten aluminum cut out in an hour. Contamination of the melt is "distinct." Life of REFRAX spouts is often several hundred hours... and there's no longer contamination.

EXAMPLE: REFRAX brick, rectangular or with tongue and groove, used in hot walls are easy to clean and maintain, resist NaCl, KCl and cryolite fluxes added to metal, speed up heat conductivity and extend wall life. Life of REFRAX hot walls consistently proves to be several times that of fireclay walls.



EXAMPLE: Automatic precision pouring of molten aluminum is governed by REFRAX float that serves as the "nerve end" of electronic system. Refractory float is of simple design, requires practically no maintenance and provides a life 4 to 5 times that of floats made of other materials.

The successful development of REFRAX refractory—a ceramic that can be *used like a metal* under conditions that metal parts can't take—is now a service-tested fact. Of equal importance, this product can be made *in a variety of compositions* to fit your particular service conditions... and scaled in cost to your price limits. For details, contact Dept. R-91, The Carborundum Co., Perth Amboy, N. J.

CARBORUNDUM®

Circle No. 18 on Reader Service Card

HOW HAMPDEN BRASS HELPED HONEYWELL'S *ElectroniK 17**

The ElectroniK 17 is Minneapolis Honeywell's all-new potentiometer . . . a compact, highly sensitive instrument for thermocouple or millivolt actuation.

*Trademark Minneapolis-Honeywell Regulator Co.

Honeywell engineers wanted 4 major castings for the front case, the door frame, the drive module, and the display module. Because the ElectroniK 17 was to have more features in a small space than any other potentiometer, intricate corings and thin walled castings were a "must." Honeywell's demand for peak performance in this new device was coupled with an equal insistence on quality components whose cost would keep the ElectroniK 17 competitive.

HAMPDEN BRASS & ALUMINUM'S DIE CASTINGS MET ALL THESE REQUIREMENTS

Aluminum Die Casting Reduced Cost, Met Desired Performance. The clean, smooth surface of the finished castings required no additional and expensive surface finishing. The inherent strength of top grade aluminum permitted the thin wall construction needed.

HAMPDEN BRASS HAD ALL THE CASTING FACILITIES FOR QUALITY, SPEED AND ECONOMY

Two 1000 ton die casting machines quickly turned out the intricately cored castings, accurate in every detail. Hampden Brass engineers and production personnel worked closely with Honeywell's designers from the initial tool designing right through to final production.

Let Hampden Brass Solve Your Casting Problems
Send for Free Brochure, "Behind the Scenes," a digest of Hampden Brass facilities.

HB

Hampden Brass & Aluminum Company
Established 1903
SPRINGFIELD, MASSACHUSETTS
Complete Pattern, Mold and Die Shop. X-ray, Laboratory and Heat Treating Facilities
NON-FERROUS CASTINGS:
Sand, Permanent Mold, Die and Structural Fiberglas.

Circle No. 35 on Reader Service Card

POTTSTOWN POTS

ARE FINE MELTING KETTLES! WE MAKE DISTINCTIVE CAST IRON PRODUCTS FOR THE LEAD, ZINC AND ALUMINUM INDUSTRIES.

★ MANY SIZES IN STOCK
★ OTHERS QUOTED ON REQUEST!
★ CIRCLE NUMBER BELOW FOR FREE BROCHURE
★ OR PHONE FAculty 6-3710

POTTSTOWN MACHINE CO.
ROHLAND & CENTER AVENUE
POTTSTOWN, PA., U. S. A.

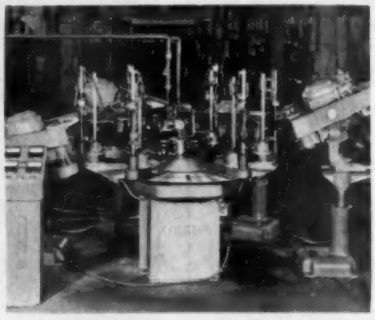
Circle No. 62 on Reader Service Card

new products & developments

Continued

Rotary automatic contour polisher

DIVINE BROTHERS CO.—The Model RJ4X is capable of finishing as many as 1000 small parts or tools



per hour, and was initially designed for polishing or grinding contours previously accessible only by hand methods, such as hand tools, firearms, jet blades, bicycle and automotive parts. The unit can also be modified for high-speed polishing of flat surfaces.

Circle No. 250 on Reader Service Card

Low-priced surface inspection gauge

BAUSCH & LOMB, INC.—The Scratch Depth Gage measures scratches, grooves and indentations on flat or curved surfaces.

Measurements to an accuracy of ± 0.001" or 5% of the depth, whichever is greater, can be made

for indentations with depth from 0.0002" to 0.016"; widths from 0.001" to 0.050" can be determined to ± 0.001". The same range applies to the measurement of raised portions.

Circle No. 251 on Reader Service Card

Circle No. 61 on Reader Service Card

THIS TRIGGER is your control over mold cavity surfaces - cleans, cools, lubricates in ONE OPERATION

SELF-AGITATING LUBRICANT CONTAINER

Get more usable castings with the P-W SYSTEM—universally accepted throughout the die casting industry.

GUN UNITS AVAILABLE SEPARATELY

Write for additional information to

PIERCE-WALLER, INC.
KETTERING P. O. Box 2121
DAYTON 29, OHIO

Magnaflake

For Over 20 Years Manufacturers of

METAL POWDERS

ALUMINUM
BRASS • COPPER
FLAKE, GRAIN AND ATOMIZED FORMS

magna

MANUFACTURING COMPANY, INC.
Plant: HASKELL, NEW JERSEY
TEMPLE 5-1200. CABLE:"MAGNAFLAKE"

Circle No. 48 on Reader Service Card

FOR DESIGNERS AND PRODUCT PLANNERS

*PDCS
*PROTOTYPE DIE CASTING SERVICE

ANSWERS ALL THESE PROBLEMS

If part of the product you are planning is to be a die casting . . . PDCS holds the solution to situations like these . . .

Your customers want samples of your product and you need die castings to complete your samples.

You must test the function of a new assembly which includes a die casting.

You are required to test the strength of a die casting as applied to your needs.

You want to judge the "feel" or appearance of a die casting before final specification.

You must hold down the cost of new product development by avoiding expensive design errors.

You are interested in market testing the sales appeal of a new product and die castings are required to build the needed samples.

PDCS is a newly developed process for creating production-like die castings, in small quantities, at low cost, without permanent tooling charges. Find out for yourself how PDCS can help you by filling out the coupon below and mailing it today.

NEWTON-NEW HAVEN CO.
430 Third Avenue
West Haven, Conn.
NEWTON NEW HAVEN

CUSTOM PRODUCERS OF DIE CASTINGS

I have a problem to which PDCS may be the answer. Without cost to me or my company . . .

☐ Prints ☐ Models ☐ Sketches are being forwarded under separate cover. Please submit your cost estimate.
☐ Have your representative call.
☐ Send me your free folder, "PDCS . . . Prelude to Production".

A

NAME:_____
TITLE:_____
COMPANY:_____
ADDRESS:_____
_____

Circle No. **57** on Reader Service Card

Batch mixer

KOL, INC.—The M-61 Mixal is a rotating drum mixer with a stationary removable paddle. Any five-gallon steel drum can be used, and many materials can be mixed in

their own shipping drum. An adapter to hold one-gallon cans is also available. The unit weighs 55 pounds complete.

Circle No. **252** on Reader Service Card

Vacuum control unit

NRC EQUIPMENT CORP.—Protectovac, a 10-pound unit, automatically maintains any preselected level of pressure from 40 to 1000 microns

for vacuum furnaces, coaters and pumping systems. The device reads a signal from an NRC type 521 thermocouple gauge and opens and closes 5 amp. contacts which operate external circuits at the selected pressure point.

Circle No. **253** on Reader Service Card

Abrasive media

AUTOMATION SERVICES, INC.—Hydrabrasives are now available for all wet-blast applications in straight or inhibited form. They are accurately graded and available from coarse to micron-flour sizes in aluminum-oxide, beads, Novaculite, various ores, natural and synthetic grain, grit, and shot.

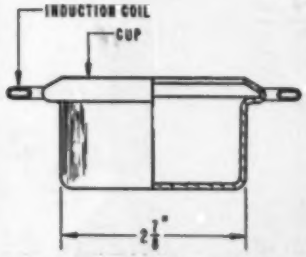
Circle No. **254** on Reader Service Card

LepeL
HIGH FREQUENCY *Induction* HEATING UNITS

Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

Typical Induction Heating Applications

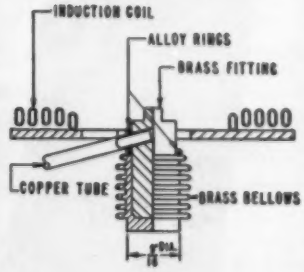
Stainless Steel Cups Selectively Annealed



Flanges of cups made from type 321 stainless steel are selectively annealed by induction heating prior to further forming. Flanges are heated to 2000° F and water quenched. Single-turn coil restricts heating to the flange area.

Our engineers will process your work samples and return the completed job with full data and recommendations without cost or obligation.

Bellows Assembly Brazed



Brass bellows and copper tube are simultaneously silver-alloy brazed to a brass fitting by induction heating. Plate-type induction coil produces proper temperature at each joint.

WRITE FOR NEW LEPEL CATALOG
LepeL HIGH FREQUENCY LABORATORIES, INC.
55th ST. & 37th AVE., WOODSIDE 77, N. Y.
CHICAGO OFFICE 6246 WEST NORTH AVE.

Circle No. **45** on Reader Service Card

Attach this ad to your Letterhead for a copy of our Catalog.

Cat. No. G-824 7 Deg.
Actual Size

Conical Tool Company

3890 Buchanan Ave., S. W.

GRAND RAPIDS — MICHIGAN

Circle No. 23 on Reader Service Card

PMM opportunities

jobs and equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Road, Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITION WANTED

Powder Metallurgy Man. Strong Production Supervisor. 20 years experience in all phases of Powdered Metals. Box 8461.

Available: Powdered Metal Engineer, tooling and process. Fully capable of designing tools, conducting tool tryouts, estimating part costs, metallurgy, managership and sales experience. Box 9461.

POSITION OPEN

MANUFACTURERS REPRESENTATIVES

Large Eastern manufacturer of structural Powdered Metal parts looking for aggressive representation in Ohio, Indiana, Illinois and Michigan. Other areas also open for consideration. Please advise background, territory now covered, present lines handled and other pertinent information. Write D. B. Leavitt, General Manager, Powdered Metal Div., Merriman Bros., Inc., 185 Amory St., Boston 30, Mass.

Manufacturers representative — well established, to concentrate on the sale of aluminum extrusions. Requiring secondary fabrication operations such as mitering, notching, bending, etc. — also finishing operations such as polishing, bright dipping, satin etch and anodizing. Commission basis, exclusive territory. Box 9861.

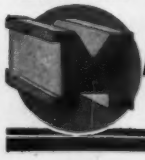
You Get EXTRA VALUES

— when you Specify
DIE CASTINGS
by
MILWAUKEE

Z

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

- Extra values provided by the modern Milwaukee plant with every facility for Complete Die Casting Service.
- Extra values provided by more than 52 years of continuous service to industry in producing precision die cast parts for all types of assemblies from small intricate instruments to heavy-duty equipment.
- Extra values provided by die castings which add to the worth of your products in design, appearance, sales appeal and efficient operation.



MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

Circle No. 50 on Reader Service Card

DIE CASTING SUPERVISOR

Experienced man required to supervise shop with 20 modern Zinc and Aluminum machines. Must have knowledge of Die Design, Gating, Venting, Die and Machine Repairs. Prior supervisory experience absolutely necessary. Excellent opportunity for the right man. Location — Southern California. We are seeking a practical shop experienced man. Does not have to have college degree. Send qualifications and salary desired to Box 9661.

SALESMAN WANTED — Company located in the East, licensed to use the Shaw Process for making cast molds in Beryllium Copper or Steel offers excellent opportunity to Salesman with following in the Mold Making, Plastics, Die-Casting industries or other allied fields. Various territories available. Send resume stating full qualifications and experience. Box 9761.

WANTED MFG. REP. — New Aggressive Die Casting Facility, midwest location, Zinc and Alum. — 8 machines, 400-750 ton present capacity, with own Tool and Die Shop. Many territories open. Only live wires need reply. Box 9561.

CHIEF ENGINEER WANTED — Growing Midwest die caster manufacturing zinc and aluminum die castings along with plating and painting requires the services of an experienced chief engineer. This man must either have served in a similar capacity or as an assistant in this capacity. This is an excellent opportunity for the right man and offers an excellent future. Box 9361.

POWDERED METALS—We are looking for a man with practical experience in designing and building compacting dies for powdered metal. Excellent opportunity with established, growing company. Please submit complete resume. All replies confidential. Reply Box 9161.

SALES ENGINEER—PRODUCTS FROM POWDERED METALS. Technical and sales experience desired. Midwest Territory. Excellent potential. Box 9261.

EQUIPMENT

WANTED—Used DIE CAST MACHINES and secondary equipment of any type. Iron Machinery Co., 400 East 142nd St., Dolton, Illinois.

FOR SALE—50 Die Casting Machines—Used —thruout U.S.A. Send for list. Lake Erie 300 ton (4) Zinc, some rebuilt.

WANTED—machines to list, also to rebuild for resale or for your own use. Fred C. Ziesenheim, M.E., 523 King Ave., Marion, Ohio.

PMM index of advertisers

A

Abbott Ball Co., The 98
Acheson Colloids Co. 40
Acromark Co., The 98
Alan Wood Steel Co. 44
Alloys & Chemicals Corp. 11
Aluminum Smelting & Refining Co. ..... Cov. II
American Foundrymen's Society 108
American Mannex Corp., Easton Metal Powder Div. 20
American Smelting & Refining Co. ... 19
American Zinc Sales Co. 22
Apex Smelting Co. ..... Cov. IV
Atols Tool & Mold Corp. 5
Atlantic Casting & Engineering Corp. 112
Auto Diesel Piston Ring Co., The ... 49

B

B&T Machinery Co. 77
Badger Die Casting Corp. 110
Baldwin-Lima-Hamilton Corp. 24
Bethlehem Steel Co. 21
B. I. P. Engineering Ltd. 109
British Industries Corp., DCMT Div. .. 25

C

Carborundum Co., The Electro Minerals Div. 93

Continued on next page

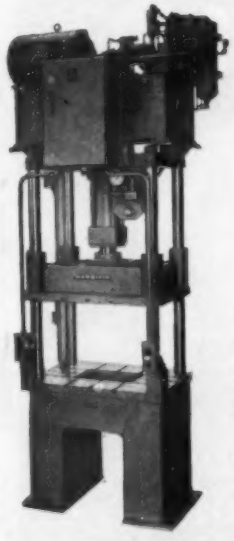
HANNIFIN

HYDRAULIC

DIE CASTING TRIM PRESSES

Give you more parts per hour

OPEN GAP OR COLUMN TYPES



- High speed operation
- Easier set-up
- Longer die life
- Complete operator safety
- 2 to 150 tons

Faster Speeds • Lower Prices • Quick Delivery

YOU GET THESE FEATURES:

1. Safe, dual electric (or hand) controls
2. Automatic reverse on pressure or distance (adjustable)
3. Adjustable ram pressure
4. Extra-large tables standard
5. All-steel welded and stress-relieved construction
6. Hardened and chrome-plated rams and guide rods

For the full story of the advantages of high speed hydraulic trimming, send for our Bulletin 142. Or call in your Hannifin representative—he's a trained production analyst.

3164PH

PARKER HANNIFIN CORPORATION

PARKER-HANNIFIN

HANNIFIN COMPANY DIVISION

581 South Wolf Road • Des Plaines, Illinois

PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

EUROPEAN DIVISION - PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

Circle 86 on Reader Service Card

INDEX OF ADVERTISERS

Continued

Carborundum Co., The
General Refractories 117
Donald Carroll Metals, Inc. 111
Cast-Master, H-P-M Div. 1
Certified Alloys Co. ..... Cov. II
Consolidated Mining & Smelting Co. of Canada, Ltd. 47
Crucible Steel Co. of America 28
Conical Tool Co. 120
Consolidated Astronautics, Inc. 108

D

Darnen Tool & Engineering Co., Inc. 94
Denver Fire Clay Co. 99
D-M-E Corp. 88, 89, 90
Diecasters, Inc. 108
Dow Corning Corp. 35

E

Efficient Tool & Die Co., The 13
E.M.B. Co. Ltd. 45
Engis Equipment Co. 46

F

Wm. M. Fiore, Inc. 104
Fiske Brothers Refining Co. 94

G

Graphite Products Corp. 111
Gries Reproducer Corp. 43

H

Hammond Machinery Builders, Inc... 96
Hampden Brass & Aluminum Co. ... 117
Harbison-Walker Refractories Co. 17, 18
Hitchiner Manufacturing Co. 32
Hoeganaes Sponge Iron Corp. 8
Hoover Co., The ..... Cov. III
E. F. Houghton & Co. 31
H-P-M Div., Koehring Co. 1

I

Indussa Corp. 109
International Minerals & Metals Corp. 122
Investment Casting Co. 34

K

Ken Die & Tool Co. 84
J. A. Kozma Co. 32
Kux Machine Co. 106

L

Latrobe Die Casting Co. 4
Lepel High Frequency Labs, Inc. 119
Lester-Phoenix, Inc. 6, 7

M

Madison-Kipp Corp. 48
Magna Manufacturing Co., Inc. 118
Marathon Specialty Steels, Inc. 16
Micro Metals Corp. 99
Milwaukee Die Casting Co. 120
Misco Precision Casting Co. 9
Monsanto Chemical Co., Organic Div. 14, 15
Morton Manufacturing Co., Inc. 12
Mt. Vernon Die Casting Corp. 42

N

National Lead Co., Doehler-Jarvis Div. 38
New England Die Casting Co. 51, 52
New Jersey Zinc Co., The 102, 103
Newton-New Haven 119

O

Oakite Products, Inc. 95
Olin Aluminum 2

P

Paramount Die Casting Co. 104
Parker-Hannifin Corp. 121
Peerless Gear & Machine Co. 103
Pierce-Waller, Inc. 118
Pottstown Machine Co. 118
Precision Castings Co. 39

R

Reed-Prentice Div. of Package Machine Corp. ... 36
Reese Metal Products Corp. 113

S

St. Joseph Lead Co. 50
Southern Die Casting & Engineering Co. 113
F. J. Stokes Corp. 39
Superior Industries, Inc. 78
Syntron Co. 97

T

Tiffin Foundry Co., The 49
A. Triulzi 30
Twin City Die Casting Co. 33

U

Uddeholm Co. of America 43
Union Carbide Chemicals Co. 41
Universal-Cyclops Steel Corp. 100

V

Vascoloy-Ramet Corp. 26

W

Wheel Trueing Tool Co. 112

HUDSON BAY

SLAB ZINC 99.99+%

A QUALITY PRODUCT WHICH MEETS THE MOST EXACTING REQUIREMENTS OF THE DIE CASTING INDUSTRY

INTERNATIONAL MINERALS and METALS CORPORATION

11 BROADWAY • NEW YORK 4, N.Y.

Circle No. 42 on Reader Service Card

If it's speed you're after...

call a Hoover Man

Hoover's not directly involved with space travel. But we're a down-to-earth company serving many topflight industries. We produce quality castings, and have been doing it for 36 years. Whatever you want in aluminum or zinc alloy castings, you can count on Hoover for speedy service. We'd like to prove it to you. Call one of our Sales Engineers . . . he'll give you the whole story.

THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio Die Casting specialists since 1922
In Canada — Hamilton, Ontario

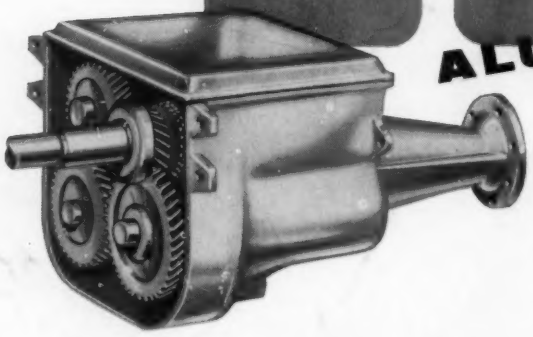
DIE CASTING *by* HOOVER

Circle No. 38 on Reader Service Card

APEX 39-11

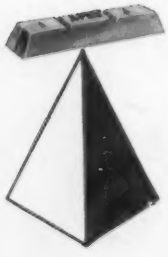
ALUMINUM ALLOY

(WITH 11% SILICON)



increases yield, saves foundry dollars on tough die casting jobs

When the die casting job calls for greater fluidity and pressure tightness, you'll be money ahead by specifying Apex 39-11. This aluminum alloy, containing 11% of silicon, consistently assures castings of uniform high quality. It permits production to proceed smoothly and results in a quality product, meeting rigid standards of dimensional accuracy. Apex 39-11 castings have good as-cast surfaces and above-average mechanical properties, too. Like all Apex alloys, Apex 39-11 is laboratory-controlled to meet industry's most rigid specifications. Here's another fine product of Apex research—one you can rely on every time!



Research leadership back of every ingot

Send for our helpful booklet, ***Die Casting Alloys.*** *Shows composition, properties, other data on Apex products. No obligation.*

Warehouse distributor of ALCAN foundry alloy ingot

APEX SMELTING COMPANY

CHICAGO 12 • CLEVELAND 5 • LONG BEACH 10, CAL.
SPRINGFIELD, OREGON (NATIONAL METALLURGICAL CORP.)

Circle No. 9 on Reader Service Card